

Path. 294^e

Davey

DEK Row n 58.

9.

THE
GANGLIONIC NERVOUS SYSTEM;
ITS
STRUCTURE, FUNCTIONS, AND DISEASES.

[Handwritten signature]

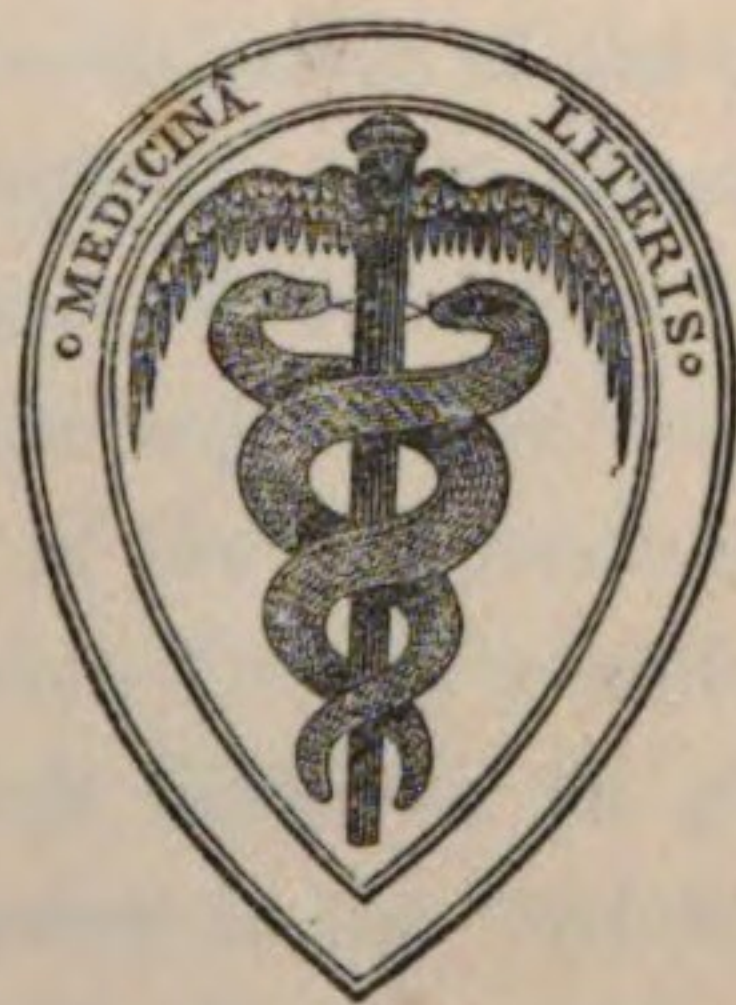
THE
LIBRARY OF THE
BOSTON PUBLIC LIBRARY
ASTOR LENOX TILDEN FOUNDATION
170 N. BOSTON ST. BOSTON, MASS.

THE
GANGLIONIC NERVOUS SYSTEM;

ITS
STRUCTURE, FUNCTIONS, AND DISEASES.

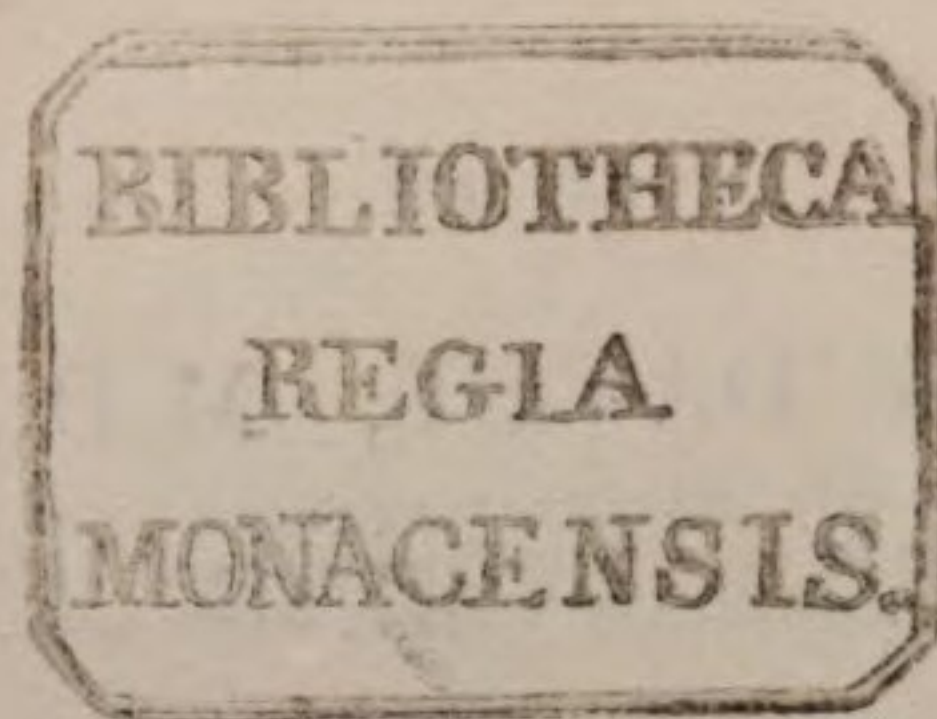
BY
JAMES GEORGE DAVEY, M.D., M.R.C.S., LOND.,

PHYSICIAN (HON.) TO THE STAPLETON GENERAL DISPENSARY, NEAR BRISTOL;
FORMERLY MEDICAL SUPERINTENDENT (F. D.) OF THE COUNTY ASYLUMS FOR THE INSANE AT HANWELL
AND COLNEY HATCH, MIDDLESEX.



LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.

MDCCCLVIII.



PRINTED BY J. E. ADLARD,
BARTHOLOMEW CLOSE.

CONTENTS.

INTRODUCTION	1
------------------------	---

CHAPTER I.

STRUCTURE OF THE GANGLIONIC NERVOUS SYSTEM.

Peculiarities.—Subdivisions of the solar plexus.—Various communications between the ganglia of the sympathetic and the cerebro-spinal nerves.—Incorporation of the ganglionic nerve structure with the cerebral and spinal nerve ramifications.—Relations of the gray and white substances to each other.—The ganglionic nerve-tissue constitutes a great part of the volume and weight of the whole body.—Nervous structure either incorporated with the organism or “distinct;” remarks thereon.—Mr. Anderson’s sketch of the comparative anatomy of the nervous system.—Monad and man.—The early embryo of man and that of some of the lower animals found to be precisely alike.—Nervous globules.—The nervous system in the “asterias” and “mollusca;” its concentration in the whelk, limpet, snail, and doris, &c.—The “cyclo-ganglionic nervous system” takes precedence of both the cerebral and spinal systems.—Mr. Anderson’s views.—Dr. Carpenter and the “cell-globule,” its form and endowment; and probable basis of both animal and vegetable matter.—“Transformation of tissues.”—Cells <i>versus</i> “nervous globules” (Anderson).—Anatomical and physiological conclusions.	37—66
---	-------

CHAPTER II.

ON THE FUNCTIONS OF THE GANGLIONIC NERVOUS SYSTEM.

Inaccuracy of the early writers.—Progress of more correct views as to “life.”—Bichât, Gall, and Walker.—The researches of Le Gallois; their seeming identity with those of Dr. M. Hall.—Doubtful conclusions from vivisections.—Dr. M. Hall <i>versus</i> Cuvier, Richerand, and Gall.—Retained nervous power; views of Proschaska and John Hunter.—Experiments of Sir B. Brodie; their great value.—“Irritability” the function of the “organic nervous system.”—The integrity of the spinal organism and the maintenance of the excitatory phenomena due to the ganglionic nervous system.—The <i>animal</i> and <i>organic</i> functions; their respective merits.—Müller’s “organizing principle.”—The opinions of Abernethy, Hunter, and Lawrence, on the vital principle.—The ganglionic nervous system first formed in the embryo.—The “ <i>nisus-formations</i> ,” views of Müller, Blumenbach, and Elliotson.—Monstrosities; cases by Mr. Lawrence and Dr. M. Hall.—Roget, and others, erroneous views of, with regard to cerebral influence.—Opinions of the author, and corroborative experiment on the frog.—Reason why <i>idiots</i> are short-lived.—The ganglionic nervous system when seen in monsters has been mistaken for remnants of the cerebro-spinal nerve-matter.—Blows near the solar ganglion, Sir Charles Bell on.—Annelidæ, their division into parts.—Arrest of development, its cause, &c.—Death.—Further experiments of Sir B. Brodie, of Sharpey, and Schroeden.—Error of Müller, absence of the eyes.—The “formative power” an effect (function) of the ganglionic nervous system.—Organization.—Sleep.—Respiration.—Animal heat.—Instinct.—Dr. Carpenter’s views on instinct.—The line of demarcation between instinct and reason, not unfrequently, but feebly, and erroneously traced.—The late Dr. Prichard’s opinions, his anti-phrenological tendencies.—Müller’s notions of instinct.—Quotation from Dr. Roget’s ‘ <i>Bridgwater Treatise</i> ,’ vol. ii.	67—154
APPENDIX TO CHAPTER II.	155—189

CHAPTER III.

THE PATHOLOGY OF THE GANGLIONIC NERVOUS SYSTEM.

The cause of abnormal action <i>versus</i> effects.—Baillie, Bright, Andral.—Death oftentimes the consequence of changes of structure which

escape the senses.—Classifications of Cullen, Good, and M'Kintosh.— Kreysig's views and opinions, as quoted by Mr. Lee.—Organic nervous system liable to be variously affected, to either an excess or a decline of power, to either temporary or permanent disorder.—Vital affinities.—Fever, cholera.—Dr. Steven's views.—General identity of fever and cholera.—General characters of "cholera."—Syncope, its various kinds.—Treatment.—Remarks by the late Mr. Liston.— Fatigue and death.—Mr. B. Cooper's case of syncope during an operation.—Fear, its effects sometimes fatal.—Cases.—Morbid action of the capillaries due to the organic nervous system; its cure by tonics, &c.—Quotation from Mr. Lee's book on 'Mineral Springs.' —Illustrative case.—Reciprocity of structures and organs.—Müller's opinions quoted.—Apoplexy; its various kinds.—Ganglionic apoplexy. —Mutual dependence of the great nervous centres.—Experiments of Volkmann.—Epilepsy.—Remote and proximate causes of "nervous disorders," as epilepsy, hydrophobia, tetanus, neuralgia, chorea, &c. —The "paralysis of the insane;" its description.—The paralysis of children; its seat.—Hypochondriasis.—Opinions of Copland and Prichard.—Gastralgia.—Angina Pectoris, Asthma, Pertussis.— "Morbid sensibility;" the cause of inflammatory action.—Treatment. —Dysmenorrhœa.—Mollities osseum; its seat and nature.—Dr. Cope- land's views.—Diabetes.—Dysentery.—Hypertrophy and Atrophy. —Lepra.—Decline of life (senile dementia) death.—Extract from the writings of the late Dr. A. Combe.	190—273
APPENDIX TO CHAPTER III.	273—281

CHAPTER IV.

General observations on the treatment of <i>disease</i>	282—309
---	---------

The first part of the history is a general account of the state of the country at the beginning of the reign of King Henry the First. It describes the condition of the kingdom, the state of the church, and the relations of the king to his subjects. The second part of the history is a detailed account of the reign of King Henry the First, from the year 1100 to the year 1135. It describes the king's wars, his domestic policy, and his relations to the church. The third part of the history is a general account of the state of the country at the end of the reign of King Henry the First. It describes the condition of the kingdom, the state of the church, and the relations of the king to his subjects.

The fourth part of the history is a detailed account of the reign of King Henry the First, from the year 1135 to the year 1155. It describes the king's wars, his domestic policy, and his relations to the church. The fifth part of the history is a general account of the state of the country at the end of the reign of King Henry the First. It describes the condition of the kingdom, the state of the church, and the relations of the king to his subjects.

INTRODUCTION.

It would be unfair to the memory of that distinguished physiologist, BICHAT, to allow the contents of the following pages to go forth to the profession without acknowledging his great merits and originality. In his work, 'On Life and Death,' published towards the end of the last century, there is sketched with a masterly hand, the "division of life into *animal* and *organic* life;" and, although the former is viewed in connection with the cerebro-spinal system, and although the latter is *not* regarded (else than in an indirect manner) as dependent on the ganglionic nervous system, yet did Bichat, without doubt, pave the way for a more certain and ready appreciation of the physiological facts herein submitted to the reader. At p. 22 of the work named, we are told that "*Life*—offers us two remarkable modifications, the one common to the vegetable *and* the animal; the other belonging exclusively to the latter." He proceeds, "In comparing two individuals from each of the living kingdoms," *i. e.*, the vegetable and animal kingdoms, "the one will be seen existing only within itself, having with what surrounds it the relations only of nutrition, attached to the

soil, in which its seed has been implanted, born there, growing there, and perishing there. The other will be observed combining with this interior life, which in the highest degree it enjoys, an exterior life by which it acquires a very numerous series of relations with all surrounding bodies ; a life which couples it with the existence of every other being, by which it is approximated, or removed from the objects of its desires or its fears ; and seems in appropriating everything in nature to itself, to consider everything with regard to its individual existence only.

“ Thus it might be said, that the vegetable is only the sketch, or rather the groundwork of the animal ; that for the formation of the latter, it has only been requisite to clothe the former with an apparatus of external organs, by which it might be connected with external objects.

“ From hence it follows, that the functions of the animal are of two very different classes. By the one (which is composed of an habitual succession of assimilation and excretion), it lives within itself (*internally*), transforms into its proper substance the particles of other bodies, and afterwards rejects them when they are become heterogeneous to its nature. By the other, it lives *externally*, is the inhabitant of the world ; and *not*, as the vegetable, of a spot only. It feels, it perceives, it reflects on its sensations, it moves according to their influence ; and frequently is enabled to communicate by its voice, its desires and its fears, its pleasures and its pains.

“ The aggregate of the functions of the first order, I shall name the organic life, because all organized beings, whether animal or vegetable, enjoy it more or less, because organic texture is the sole condition necessary to its existence. The sum of the functions of the second class, because it is exclusively the property of the animal, I shall denominate the animal life.”

I would refer the reader to the work of Bichat, wherein he will find the peculiar characters of the animal *and* organic lives described with singular clearness. Whilst the organs of the first are ever *symmetrical*, those of the latter are not the less certainly “irregular in their conformation.” The two hemispheres of the brain, and not less the anatomical character of the spinal cord, including the arrangement of the cerebro-spinal nerves,—are, in themselves, suggestive of the *duality* of the animal life, in all its details; suggestive too of the fact that there is a life to the right *and* a life to the left, and that each one is intended to supply the place of the other of them; whilst the absence of any such disposition of those organs subserving the organic life is equally suggestive of its unity, its indivisibility, or *individuality*. But a difference even more striking than the above, as between the animal and organic lives, is realised by *sleep*: the occurrence of which gives to the former an intermission which would be fatal to the latter; and thus it is, as Bichat affirms, “we live *internally* almost double the time that we exist *externally*.”

Now although Bichat claimed for the organic life, that life common to both vegetables and animals, or rather for those parts or organs exercising the functions of the organic life, a “mobility” or “sensibility,” *i. e.*, an *irritability*; and although he declared that upon the “organic sensibility,” &c., depends the phenomena of digestion, circulation, secretion, exhalation, absorption, and nutrition—and that, moreover, this “organic sensibility” is common both to the plant and to the animal, and that “the zoophyte enjoys it as perfectly as the most perfectly organized quadruped”—yet does it nowhere appear that he associated such “organic life,” or its specific qualities, as mobility, sensibility, or *irritability*, &c., with the ganglionic-nerve-structure: a circumstance the very reverse of what may have been anticipated. Having isolated the *animal* and *organic* lives, and

having at the same time found a full and sufficient employment for the cerebro-spinal organism, one would have thought that Bichat would have treated "the epigastric centre" with more tenderness than he has done, and not connect it *now* with the liver or the lungs, and *then* with the stomach or the heart.

Bichat, however, did much, in so far as he demonstrated, not only that the aforesaid *irritability* is common to both plants and animal, but also that this same property it is which lies at the root of, and constitutes the first great cause of, the strictly vital or organic functions—by which he meant "absorption, assimilation, growth, excretion," &c.

A highly interesting question becomes involved in the foregoing remarks—it is that of the existence of a *nervous system* in the "plant." If the *organic functions*, as they obtain in the "animal," are to be referred to the *ganglionic nervous system*; or, what is the same thing, to the *irritability* of which it is the immediate seat, it follows, admitting the existence or operation of the same "organic functions" in the vegetable kingdom, that plants are necessarily endowed with nerve-structure, and that *this* constitutes the *analogue* of the *ganglionic nervous system* in man and the higher animals.

In the spring of 1853 (now four years since), I read a paper "On the Physiological Uses of the Ganglionic Nervous System," before the Medical Society of London, an abstract of which appeared in the 'Lancet.' At p. 108, vol. ii (N. S.), appears a letter from Mr. Joseph Thompson, of the Isle of Wight, in which that gentleman, in not very courteous remarks, objects to my conclusions "because we see the organic functions performed perfectly well, and without any defect, in creatures which have no vestige of a nervous system at all; for instance, in plants and cellular animals." This appears to me to be a somewhat bold assertion. Mr.

Thompson will agree with me that the “organic functions” cannot be performed, even in *plants*, independently of some first cause; that these same functions must have some source or origin, some positive and material location. Surely, Mr. Thompson does not believe, in these days of the microscope and of electricity, in the nonsense which pleased our grandfathers, when the world had not parted with its leading strings—or chains if you will, *chains* forged by either the ignorance or the cupidity of charlatans and priests,—the nonsense which passed current under the name of *immaterialism*. If he does, we may not look for his conversion to the “new doctrine” (Thompson); our finite senses might never detect, even with the aid of art and science, what we shall be able to demonstrate as the analogue in vegetable substances of the ganglionic nervous system in man and the higher animals; but that such exists, though, perhaps, in a diffused and rudimental state, is to my mind a matter of demonstration—*logical demonstration*.

The following remarks are from the pen of the late Dr. Fletcher, and to them I would venture to solicit the particular attention of Mr. Thompson:

“Admitting that irritability or vitality, general and specific, is a property of the organized solids alone, it becomes a question of the highest interest, whether it be directly inherent in each of the organized tissues, either of plants or animals, or whether it merely appear to be possessed by them all in virtue of some one which is universally distributed over the organized being, and inextricably interwoven with every other. The characteristic actions of organized beings in general have been shown all to consist in certain movements, molecular or sensible, and the only or chief immediate instrument of motion in the higher tribes of animals is sufficiently well known to be muscular fibre; but while, on the one hand, it is by no means certain—on the

contrary it is very improbable—that it is directly upon this tissue, and not rather upon the nervous, that the vital impression by which the muscular fibre is excited to action is in these cases made, it is obvious, on the other, that in plants and quite the lowest tribes of animals we cannot regard irritability as seated in either a distinct muscular, or a distinct nervous system, since they appear to be, with very few and these somewhat questionable exceptions, equally destitute of both. The possession by them of this property is nevertheless distinctly indicated, not only by all the vital actions which they more or less constantly perform, in common with the higher tribes of organized beings, but also by certain sensible motions which many of them display on the application to them of a stimulus, apparently quite analogous to those which, in the latter, are effected by muscular contraction. Of these some of the best examples are afforded by the leaves of the Venus' fly-trap (*Dionæa*), the wood-sorrel (*Oxalis*), the humble-plant (*Mimosa*), and the sundew (*Drosera*), as well as by the pistils of the Martynia (*Martynia*), and the stamens of the barberry (*Berberis*), the prickly-pear (*Cactus*), the Roman nettle (*Urtica*), the pellitory (*Parietaria*), and the swallow-wort (*Asclepias*), all which appear to contract when a stimulus is applied to them; and how easily sensible motions may be excited by similar means in the branched-polype (*Hydra*, 2), the sea-feather (*Sertularia*, 3), the sea-blubber (*Medusa*, 3), the sea-hedgehog (*Echinus*, 5), and numerous other species among the lowest tribes of animals is sufficiently well known. It is probable, indeed, that many of these sensible motions are effected—as is known to be the case with those of the humble-plant—by the momentary loss of balance in the distribution of the fluids through the parts manifesting such motions; so that it is by a kind of turgescence in one or other direction, like that which occasions the erection of the

penis and other similar organs in the higher tribes of animals, that they are produced. But the action of the vessels, whence alone this loss of balance in the distribution of the fluids can result, does not less imply the possession of irritability than the contraction of the most obvious muscles. Irritability then is not the attribute only of a distinct muscular or a distinct nervous system, since it may exist independently of either : but, though neither of these systems may be so far developed in plants and the lower tribes of animals as to deserve to be considered as distinct tissues, we are not, on that account, justified in denying that both may exist in them in a diffused and rudimental state ; and that in this state they may be still competent to impart to the rest of the economy that property which the higher tribes of organized beings derive from these tissues only when concentrated and perfect. If then the arguments in favour of the doctrine that either of these systems is, in the latter, the immediate seat of irritability appear to be well founded, we need have no hesitation in believing that it has a corresponding seat in the former ; and should not certainly be deterred, as some have been, from regarding these arguments as tenable in their application to the higher tribes of organized beings, merely because the muscular and nervous systems are so little obvious in the lower that they seem to be quite wanting, any more than we are deterred from admitting that the lungs and heart, because so little concentrated in some tribes of beings—which nevertheless respire and propel their fluids—as to appear to be absent, are, in the higher races of animals, the chief instruments respectively of respiration and circulation.”

Reverting to Bichat's views—in so far as they relate to the contents of the following pages—it is interesting, and not less interesting than instructive, to observe the exceeding zeal with which this author prosecuted his inquiries into

the *organic functions*, viewing them, as he did, as the main-spring of "life and death." Bichat went so far as to locate the "passions" in the "organic life." He has insisted on it, that what the brain is to the understanding, the organic life is to the passions. His words are, "sensation of every kind has its centre in the brain, *i. e.*, sensation of every kind supposing impression and perception. If the action of the brain be suspended, sensation ceases; on the contrary, the brain is never affected by the passions; their seat is in the organs of the internal life." Now Bichat saw that under the influence of powerful (*i. e.*, *extreme*) emotion (passion) the functions of the organic life were affected, and hence was it that he came to associate the same as cause and effect—he drew his conclusion from extremes only, and so fell into error.

That excessive anger accelerates the circulation of the blood, that extreme joy has a marked influence upon the circulation—on the other hand, that terror, sadness, and sorrow, beyond a certain point, are characterised by a feebleness in the vascular system, causing an individual to look pale and bloodless, are most true; that violent emotion or passion, however induced, will cause even *death*, no one doubts; in fact, in the following pages such cases are put on record; but the fact is, that in all the above instances, the organic nervous system receives a *shock*, one not unlike that which attends on a crushed limb or a gun-shot wound, &c. It is true the "shock" enters through the medium of the external senses *and* their related organ (the brain), and is thence transmitted to the "internal viscera" (Bichat), or, as I should prefer to say, the *solar ganglion* and its auxiliary parts.

The words with which Bichat concludes Chap. VI of his book, devoted to the consideration of *whatever relates to the passions and to the organic life*, are well worthy of consideration,

bearing as they do on the history of this part of physiological science: "I shall not repeat the proofs of this assertion; but, supposing it to be demonstrated, I shall assert that there does not exist for the passions, as there does for the sensations, a fixed and common centre; that on the contrary the liver, the lungs, the spleen, the stomach, and the heart are turn by turn affected, and at such times form that epigastric centre so celebrated in modern works; and if in general we refer to this region the sensible impression of all our affections, the reason is that all the important viscera of the organic life are there concentrated. In fact, if nature had separated these viscera, had the liver been placed in the pelvis, and the stomach in the neck, the heart and the spleen remaining as they are now seated, in such case the epigastric focus would disappear, and the local sentiment of our passions vary according to the part affected."

After this from the pen of Bichat, we cannot be surprised that his successors inclined to the opinion, not only that the "epigastric centre" was the seat and source of the "passions," but that the same *epigastric centre* was associated in some way with (if it did not really constitute) the great and important mass of nerve-tissue, *i. e.*, solar ganglion, "there concentrated." According to Dr. Robert Lewins (the learned editor of the writings of the late Dr. John Fletcher), Bordeu, Buffon, Cabanis, Reil, and Broussais were among those who were content either to locate the passions in "the viscera of the chest and belly," or "to represent them as situated in the ganglionic system of nerves." Now, the early writers fell into a strange error; they confounded the *passions* with the *instinct*. As sympathy is to passion, so is passion to instinct said they; or, what is the same thing, instinct being a variety of passion, passion is merely a variety of sympathy. The result was, however, that the instinctive faculties of man and animals, not less than the passions, came to be con-

sidered in connection with the ganglia of the sympathetic; the contents of the second chapter of this book may dispose the reader to believe in such a *connection*; *i. e.*, so far as the instinctive faculties are concerned.

In the second chapter it is stated that portions of *ganglionic nerve-tissue* are among those parts first formed in the foetus; but Bichat, when treating “of the origin and development of the organic life,” says that it—the organic life—“comes into action almost as soon as the foetus is conceived; for as soon as the least organization is apparent, the little heart will be seen protruding its blood on all sides. The heart is the first-formed part, the first in action; now, as all the organic phenomena depend upon it, we may readily conceive in what way the functions of the inward life are thrown into exercise.” In his remarks on “natural death,” Bichat tells us that it is remarkable for the following reason chiefly;—“it terminates the animal life a long time before it puts an end to the organic life.”

“He who dies in consequence of a very prolonged old age dies in detail; his exterior functions are finished one after another; the senses are shut up successively; the ordinary causes of sensation pass over them, and do not affect them,” &c.

* * * * *

“The first and last ages of man are equally remarkable for imbecility. Old age is second infancy. The two periods of life resemble each other with regard to want of judgment; they differ only as to the cause of such defect.”

* * * * *

“The *organic life* remains with the old man after the almost total loss of his animal life, and terminates in a very different manner from that which is exemplified in the case of violent and sudden death. The latter has two periods, the first of which is marked by the sudden cessation of respiration

and the circulation, the second by the slow and gradual extinction of the other organic functions.

“The parietes of the stomach, for instance, continue to act upon the aliment which may be found there; the juices of the stomach continue to dissolve it. The experiments of the English and Italian physicians upon absorption prove that this function not unfrequently remains in a state of activity, after the general death of the body, and if not as long as some have supposed, at least for a very considerable period. Discharges of urine and fæces are often observed to take place many hours after sudden death.”

* * * * *

“The heart is the ultimum moriens.”

Whilst then, in the *old man*, “the powers of life begin to be extinguished in all the parts, and cease at the *heart*” (the body dying from the circumference to the centre); in death, “the effect of a sudden blow,” “life becomes extinct at the heart, and *afterwards* in the other parts. The phenomena of death are seen extending themselves *from the centre to the circumference*.”

I am not without hope that the contents of this book are such as will be likely to place the foregoing facts in a somewhat more satisfactory light, inasmuch as these and others of the same kind demand *not* to be isolated, but to be associated with the portion of the organism originating them; that is, with the *ganglionic nerve-tissue*.

It will be seen that I have treated of *SYNCOPE* of various kinds and of dissimilar organs; of syncope of not only the *animal* life, but of the *organic* life; and although Bichat failed to refer such a cessation of vitality to its first or rather proximate cause, yet are his remarks on “the influence of the death of the heart as to the production of general death” of great value.

“The interruption of the organic life, which has commenced

by the death of the heart, is produced at the same time by that of the lungs. The brain being dead, the mechanical functions of the lungs must cease: the chemical functions of the lungs must cease also, for want of the materials on which they are exerted: the latter are directly interrupted, the former through the medium of the brain.

“After this the progress of death is gradual. The secretions, the exhalations, the nutritive actions are put an end to. The latter are first arrested in those organs which receive the more immediate impulse of the blood, because in these such impulse is necessary to the performance of the function. The paler organs are less dependent on the influence of the heart, and consequently must be less affected by the cessation of its action.

“In the successive termination of the latter phenomena of the internal life, the vital powers continue to subsist for some time after the loss of the functions; thus, the organic sensibility and the sensible and insensible contractilities survive the phenomena of digestion, secretion, and nutrition.”

* * * * *

“The news of a very joyful or a very melancholy event, the sight of a fearful object, of a detested enemy, of a successful rival, are all of them causes capable of producing death. Now, in all these instances, it is the *heart* which is the first to die; the *heart*, whose death successively produces that of all the other organs; the *heart*, on which the passion is expended.”

Bichat proceeds—“And hence we are led to some considerations on *SYNCOPE*, an affection exemplifying, in a lesser degree, the same phenomena, which, in a greater one, is offered us in cases of sudden death. The causes of syncope are referred by Cullen to two general heads: of these there is one set which, according to him, affect the *brain*, another set which affect the *heart*.”

Bichat, however, denies Cullen's theory, and asserts that, in all cases of syncope, "the heart is the primitive seat of the attack." "The nature of syncope is well enough illustrated by the vulgar expression of being sick at heart."

I may remark here that I have known many epileptic patients die from syncope, the *syncope of the heart* of Bichat. Such is not uncommonly the last *fit*, the climax of long years of suffering and decay. There is a disposition to refer such sudden and fatal paroxysms to *fatty degeneration of the heart*; but even should such a physical condition be present in a given case, it, in common with all other forms of abnormal nutrition, must be referred to the organic nervous system: in this portion of our organism, then, is located the proximate cause of the fatal seizure occurring to the epileptic.

"There is a form of epilepsy," says Dr. M. Hall, "which I have not yet noticed. It is the *epilepsia syncopalis*. The patient, instead of turning purple, turns pale and ghastly. Sometimes this syncope is fatal." * * "The case is cardiac-syncopal." *It is cardiac*; that is to say, the heart is affected; but as a sequence. In "*epilepsia syncopalis*," there is not only no effusion of blood on the brain, nor congestion; but even the closest inspection of the whole body will, not unfrequently, fail to discover any signs of disease; proving, in the words of Copland, "that changes may take place in the nervous system (*i. e.*, the ganglionic nervous system) sufficient not only to cause the most acute disease, but even death itself, without being so gross as to be demonstrable to the senses."

Reverting to Cullen's theory of *syncope*, it occurs to me that the phenomena observed in a patient under the influence of *chloroform* in themselves illustrate both that cause (of syncope) which affects the "brain" as well as that which affects the "heart;" or, in other words, involves *the animal life*, and not less *the organic life*. Now, the object of the

inhalation of chloroform being to suspend the cerebro-spinal functions, or, what is the same thing, the *external* or *animal life*, leaving the “internal” (Bichat) or *organic life* intact, we are afforded certain practical and highly valuable data calculated to increase the safety of the patient when under the influence of this potent and *dangerous* medicine; we are taught to what length to carry the *syncope* and in what way to limit the specific effects to the *brain*, avoiding the *heart*, (Bichat) i. e., *the organic life*. Bichat taught that there are two kinds of “contractility,” “the animal and the organic contractility.” The first belongs to the “brain” and “voluntary muscles,” &c.; the second is a principle inherent “in the moving organ itself, is a stranger to the influence of volition” (*Excitomotory*—Hall), “and gives rise to the phenomena of digestion, circulation, secretion, absorption, and nutrition.” “The two,” proceeds Bichat, “are quite distinct in all cases of violent death; such death annihilates at once the animal contractility, and allows, for a shorter or a longer time, the organic contractility to be exercised; they are essentially distinct also in all cases of asphyxia; in these the first is entirely suspended, the second remains in activity.” In the *asphyxia*, then, which is induced by the inhalation of chloroform, let us beware how we push the use of it to such lengths as to endanger *the organic contractility*. It is evident that so long as the effects of the poison are limited to what Bichat calls *the animal contractility*, so long only is there safety; but under other circumstances, or when the effects of the poison exceed this limit and involve *the organic contractility*, i. e., the ganglionic nerve-structure, the life of the patient becomes questionable.”

The reckless manner in which chloroform has been employed, or, in other words, has been instilled into the vital current, and so carried into every, even the minutest, part of the body; the enthusiastic manner in which the blood, and through it the whole organism, has been surcharged with this poisonous com-

pound (chloroform), are confirmed by both the many deaths which have attended its immediate use and the increased mortality after operations at some of our large metropolitan and provincial hospitals. Had the principles embraced in the foregoing remarks been kept in view, the abuse of chloroform, of which I complain, might possibly have been of less frequent occurrence.

It may not be considered out of place to remark here that in cases of alarming *syncope*, however induced, whether or not by the employment of *chloroform*, as well as in asphyxia from drowning or hanging, &c., a portion of tow, saturated with brandy, when placed lightly on the "epigastric centre" and then set on fire, will be found a most valuable restorative means. I adopted this plan so long since as 1833 in a case of asphyxia from drowning; it is recommended in a paper published by myself in the 'Lancet' some six years since. Last year the very same treatment of *syncope from chloroform* was reported to have been practised, and successfully, by some Continental surgeon. I regret to have forgotten the source from whence this last fact was obtained.

When, in May, 1853, I read before the London Medical Society an abstract of my views "On the Physiological Uses of the Ganglionic Nervous System"¹—a notice of which essay or paper appeared in the columns of the 'Lancet' for June 25th—Mr. Walford, of Reading, addressed to me a short note, in which he claimed for the late Dr. Fletcher the credit of "establishing, on an immutable basis, the function of the great sympathetic nerve." I lost no time in accepting the advice of Mr. Walford to obtain Dr. Fletcher's work, 'Rudiments of Physiology;' and whilst it gives me the highest satisfaction in acknowledging both the originality of Dr. Fletcher and the great value of his writings on physiology and pathology, I must add that I wrote much concerning

¹ Since published (1853) in the form of a pamphlet, 8vo, pp. 20.

the ganglionic system of nerves, and advocated its "primary, essential, and independent function," not only before the 'Rudiments of Physiology' were published (1837), but long anterior to my knowing even of their existence; however, no sooner had I read the book which bears the above title, than I determined to re-write a large portion of the following pages. This I did; and the reader will directly perceive how and to what extent I have yielded all honour to the very eminent physiologist named (Fletcher).

That the subject of *the physiology and pathology of the ganglionic nervous system* has been one uppermost in my mind from the earliest period of my medical career is proved by a reference to the pages of the 'Lancet,' written twenty-one years since. In vol. xxx ('Lancet'), 1835 and 1836, there is contained my first-published essay on this interesting matter: it is headed "The Pathology of Fever and Cholera." A reference to it will show the grounds on which I viewed the great sympathetic nerve as the seat of the diseases named, and as furnishing, under the pressure of abnormal action, the proximate cause of the same. I wrote a continuation of this same paper, after a few months, and forwarded it to the Editor of the 'Lancet,' but this gentleman declined its acceptance, or, what is the same thing, refused it a place in his widely circulated journal. As I kept no copy of this manuscript, and as I did not succeed in regaining possession of the document, I can only remark in reference to it that my object was to further illustrate my positions, as above mentioned, by certain analogous or related facts and principles having reference, more or less directly, to the ganglionic nerve-structure, under circumstances either of health or disease, *i. e.*, of normal or abnormal action. My second paper constitutes, in fact, a more exact and searching analysis of the subject in hand than I had before attempted; that I took some considerable pains in the composition

of the paper alluded to I know full well, but *love's labour is often lost*.

Vol. xl ('Lancet'), 1841 and 1842, has in it a paper from my pen, which treats of several points relating to the *physiology* and *pathology* of the organic or vital nerves; and to this I would beg to invite the reader's attention. During my residence at Ceylon, from 1844 to 1849 inclusive, I wrote what may be called a first edition of the contents of the following pages; and in 1850 the Editor of the 'Lancet' accepted the offer of my manuscript, with the view to its appearance, *seriatim*, in the journal named. However, after the publication of some five or six essays, or parts, Mr. Wakley and I disagreed on certain matters, and the further publication (in the 'Lancet') of my 'Physiology and Pathology of the Ganglionic Nervous System' was interrupted. A comparison of the said "essays," or "parts," as they appear in the 'Lancet' (1850), with the contents of the second chapter of this book, which treats of the physiological part of the subject, will demonstrate the fact above stated, viz., that this present undertaking is very much more like a second edition than otherwise. I may add, all that which did appear in the columns of the 'Lancet' was reprinted, without any loss of time, in vol. xxii of Braithwaite's 'Retrospect of Medicine;' the proprietor and editor of which declared the same to be a "desideratum" and "well worthy," "from its novelty and originality," "of attentive perusal."

The next step taken by me in this direction, was to write a paper 'On the Physiological Uses of the Ganglionic Nervous System,' being an abstract of the *series of articles* just alluded to as appearing in the 'Lancet' for 1850. This I read, in May of 1853, before the London Medical Society; and the notice of this in the pages of the 'Lancet' it was which led to the issue of the letters of Messrs. Walford and Thompson above referred to. (See 'Lancet,' vol. ii, N. S., 1853.) After-

wards, in March, 1854, I read, at the Bath and Bristol branch of the British Medical Association, an 'Essay on the Excito-motory System of Dr. M. Hall;' in which I referred all of its phenomena, both under circumstances of health and disease, to either the normal or abnormal operation of the ganglionic nerve-tissue, &c. This paper is to be found in the journal of the Association for the period named; it constitutes also the *appendix* to the second chapter of this book. Furthermore, a reference to vol. i, 'Lancet,' N. S., May or June, 1854, will prove that I have not failed to *ventilate* this department of mental science.

There are two reasons why I have ventured to offer the foregoing remarks to the reader's attention,—one is, that the question of priority raised by Mr. Walford (see letter in 'Lancet') may receive a satisfactory solution; and another is, that he, or they who would ignore the humble efforts of a brother-practitioner made in the cause of science and truth, may perceive the very frail excuse for so doing, which is open to him or them; these are no idle words.

I am reminded that in No. 42 of the 'Dublin Quarterly Journal of Medical Science,' there are contained certain remarks from the pen of Dr. Robert Reid. He writes thus, viz.:

"My attention has been directed to some lectures which have been published in the 'Lancet,' by Dr. Marshall Hall, in which that physician claims to have been the first who undertook to point out the arrangement of the nervous structures in the animal body into three divisions; which, he says, he has distributed as having relation to three centres, viz., the cerebral, the spinal, and the ganglionic systems. I think it right to state, that *some years* prior to his statements on the subject, the medical public might have been acquainted with such a distribution of the nervous structures, by essays which I had published. These papers have been noticed by

almost all the medical journals, both foreign and domestic, of the day. It is difficult to suppose how Dr. Marshall Hall could have avoided meeting with statements which bore such relation to subjects in which he seemed to be so much interested. I may mention, of these, a treatise, by me, on 'Tetanus and Hydrophobia,' which was published in 1817; and an 'Essay on Fever,' which was published in the third volume of the 'Transactions of the College of Physicians of Ireland,' in the year 1820.

"Dr. Marshall Hall states, that his first memoir was published in the 'Philosophical Transactions,' in June, 1833; and his second memoir, which was rejected by that learned body, was given to the public in 1837. In his anxiety for priority of publication, his 'Lectures on the Nervous System,' published in 1841, he says were written in 1835.

"From these evidences it appears clearly that Dr. Marshall Hall is not the first who promulgated the fact that the nervous structures in the animal frame are by nature distributed into three centres, to which all their influences are reciprocally referred. With these facts before his eyes, it is difficult to conceive how Dr. Marshall Hall could make an assertion that he was the first who stated these views of the nervous structures.

"I should not have taken notice of these facts, but that the want of a real acquaintance with the functions of each of these centres has led to the inextricable confusion with which these writings have obscured the simplicity of the subject."

For my own part, I am quite inclined to believe that Dr. M. Hall is very greatly indebted to the labours of Bichat, Gall, Brechet, Blane, Mayo, and Reid; and, perhaps, more so than a perusal of the writings of this eminent writer and physiologist allow us to perceive. This may be rather accidental than otherwise. Now, Dr. M. Hall alludes to the fact of the spinal cord *not* being an extension of cerebral

substance—*not* a cord of cerebral nerves; he writes as if this idea originated in himself. There appears reason to believe that, in 1810, Gall wrote concerning the medulla spinalis, and at that time declared it to be a distinct organ, and to preside over a set of functions of a kind dissimilar to those appertaining to the cerebral organism. Bichat, sixty years since, taught, not only as has been above explained—that there are two kinds of *contractility*, the one *animal* (“a property of life”), and the other *organic* (“a property of texture”), and that whilst the first is at once annihilated “in all cases of sudden death,” the second, *i. e.*, the organic contractility, is continued for a longer or a shorter period,—but also that these two kinds of contractility “are distinct both in artificial palsy and in that which is brought on by disease. In these the voluntary motions cease; the organic motions are unaltered.” To the same effect wrote Mayo,—retraction, said he, is manifested in the limbs, when “pricked,” even though these are paralysed, or, what is the same thing, deprived of sensation and motion (voluntary) by disease. Certainly Bichat and Brechet anticipated Dr. M. Hall’s views concerning the action of the sphincters, in so far as they act as sentinels to the inlets and outlets of the body, &c. The first named recognised in them a specific power (organic contractility), which has no direct or necessary relationship to either the cerebral or spinal (*i. e.*, the animal) functions; he taught that this specific power is exercised by the sphincters even after the apparent death of the individual; and that hence it was the urine and fæces so often escaped from the bladder and rectum, even hours after life had ceased. The second (Brechet) taught, at a period anterior to the publication of M. Hall’s first memoir in the ‘Philosophical Transactions’ in 1833, that the sphincters were more generally than otherwise without the reach of any cerebro-spinal influence, and that they exercised their peculiar functions in

virtue of the ganglionic nerve-structure. Bichat and Brechet were of opinion that the sphincters were, as a rule, intermediate between the organic and animal functions, and belonged not less to the *internal* ("vital," Hall) than to the *external* life,—to borrow the expression of Bichat himself. In the appendix to the second chapter of this book, the reader will find the author's views, on this subject, explained.

That the late Mr. Mayo, not less than Blane, Le Gallois, and perhaps others, recognised and described the excitatory phenomena before Dr. M. Hall, cannot be well doubted; as to the first named, he erred certainly in supposing that these were, for the most part, due to the retention by the spinal cord, after decapitation, &c., of a certain cerebral influence. Dr. M. Hall it was who, more clearly and more successfully than any predecessor or contemporary, dissociated the *true spinal functions* from the brain, i. e., *voluntary motion*.

I must be permitted to add, that it strikes me as somewhat strange that Dr. M. Hall should be disposed to claim for himself so large a share of credit and distinction for his mere opinions. He asks—"Had it been stated in any work that the deglutition of water by the pharynx—the expulsion of carbonic acid by the larynx—the retention of the urine and fæces by the sphincters, are exclusively functions of the spinal marrow, and of a peculiar system of motor and excitor nerves—of which it is the central axis?" There are those who believe rather with Brechet than with Hall—that "ingestion" and "egestion" are associated rather with the ganglionic nervous system than with the spinal. For my own part, I doubt not that both these acts named are consequent on a compound agency, and due equally to the ganglionic and spinal nerve-matter. The future investigations of independent minds will solve the value of Dr. M. Hall's original statement, in so far as the exclusive dependence of the action of the sphincters on the "spinal marrow" is concerned.

That Dr. M. Hall claims too much for the *spinal cord*—for the true spinal or excito-motory functions—is to my mind most clear: it will be one day admitted that this distinguished man has overshot his mark. Too intent and resolved to establish his doctrines on a firm basis—one that shall last for all time—he has, in my humble judgment, outstepped his prudence, and now sees all things, physiological and pathological, through a coloured medium—through *excito-motory* spectacles—so to describe the fascination, or *illusion*, more properly.

I would submit the following, viz.: “In the experiments in which the cerebrum, the *centre* of the sentient and voluntary system, is removed, and in diseases, and in other experiments, in which the upper part of the spinal marrow is disorganized or divided, the phenomena which remain are entirely of the excito-motory class. Sentient and voluntary nerves are blended with the excitor and motor nerves, but their functions are suspended when the influence of the centre of the system is cut off. The centre of the excitor and motor nerves being appropriate portions of the spinal marrow itself, the functions of these nerves remain.

“Still, the two sets of nerves are generally blended anatomically. *If they be distinct in any class of animals, it is, probably, in the Invertebrata, and especially in their lowest forms, in which sensation and volition are nearly extinct, and the animal lives a sort of excito-motory life only.*

“But if the existence of a *distinct* anatomy of the excito-motory system be doubtful, that of the *blended* anatomy, and that of the distinct physiology, pathology, and therapeutics of this system, are perfectly obvious.” (Hall.)

Now, if Dr. M. Hall will insist on it that the strictly vital acts of the “Invertebrata”—of those animals which are without either a brain or a spinal cord—are to be viewed as a part and parcel of *the true spinal functions* (for to this must his position

come at last), and are *not* to be considered as having any dependence on a ganglionic nerve-tissue, he places himself, as it seems to me, in some difficulty as to the origin or source of *the strictly vital acts* belonging to and in full operation in the *amyencephalous* being; otherwise it rests with him to show that the vital acts, as nutrition, circulation, absorption, &c., as performed by the said *Invertebrata*, are dissimilar to the same when occurring to the brainless and marrowless monstrosity. Moreover, Dr. M. Hall himself refers the growth and maturity of the foetus in utero—if a creature without either a brain or a spinal marrow can be so called—to the ganglionic nervous system; and, what is a very material point, he contends that all the irritability of the internal organs, in both man and animals, doubtless depends on the ganglionic system; and very much of that also which obtains “in the muscles of the limbs” may depend, he adds, on the same system.

It must not be forgotten that, in the face of all this, Dr. M. Hall declares the true spinal functions (the excito-motory phenomena) are altogether independent of the ganglionic nervous structure. (See appendix to Chapter II).

It is difficult indeed to agree with Dr. M. Hall, when he teaches not only that the vital phenomena (including, of course, *circulation*) in operation among the lower animals are, in themselves, *spinal, i. e.*, “excito-motory;” but *also* that the destruction of the brain *and* cord in a frog “does *not* affect the capillary circulation, because the ganglionic system is entire.” Dr. M. Hall insists, strangely enough, that the ganglionic nerves are without *sensibility*; but I find it quite impossible to follow this gentleman, so “inextricable” (Reid) do his statements not unfrequently become.

A paper was read some two or three years since, before the Medical Society of London, by Dr. Thudichum, “On the Cause of the Emptiness of the Arteries after

Death." I read the paper with much interest, but felt a little disappointed at not finding some definite *conclusion* to the argument advanced. It appears to me, that Harvey did well to divide the labour of the circulation between the heart *and* the arteries, and to invest the latter "with an active propulsive force;" and, after due consideration, I am disposed to consider that Dr. A. Mercer Adam has deserved well of the profession, for advocating the existence in the arterial vessels of *an inherent muscular contractility* by means of which the said vessels are emptied of their contents. Dr. Thudichum objects both to the theory of Harvey and to that of Dr. Adam; but I would venture to remind him, that inasmuch as the *arteries* are everywhere made up of so abundant a proportion of ganglionic nerve-tissue, their organic contractility is to be directly assumed. The anatomy of the arterial system being known, its specific function comes, at once, to be anticipated. What say Messrs. Kirke and Paget, in their 'Handbook of Physiology?' "The normal contraction of arteries is probably excited through the instrumentality of the nerve-fibres of the sympathetic system distributed to their walls, and connected through the medium of ganglia with the fibres supplying the organ to which such arteries convey blood." The emptiness then of the arteries after death is due primarily to the ganglionic nerve-structure; and secondarily to the "active propulsive force" which this nerve-structure so unceasingly supplies to the said "arteries."

In No. x (N. S.) of the 'British Medical Journal,' there is a highly interesting article on "The Atrophy of Limited Groups of Muscles," from the able pen of Dr. F. Brittan, of Bristol. It contains the particulars of cases of this rare disorder occurring in Dr. Brittan's practice; these are well deserving the attention of the pathologist. The object I have in view, in alluding to the article named, is that of

demonstrating what I conceive to be the seat and nature of "muscular atrophy" so-called. My attention was first directed to the disease so long back as 1838. The gentleman afflicted with "muscular atrophy" was a personal friend of my own, a resident at Portsmouth, but not my patient: he was under the care of a first-rate surgeon, the late Mr. Martell, also of Portsmouth. The history of the case was this: Mr. W— complained first of a sense of stiffness and want of power in the right deltoid, this went on increasing; ere long, the muscle began to waste away. After some three or four months, the outside of the shoulder was perfectly flat, the deltoid itself had positively disappeared; I need hardly add, there was, at this time, no remnant of motive power. Before the right deltoid had reached so decided a state of degeneration, the left deltoid became similarly affected, and, after a time, realised just the same condition of emaciation and uselessness. The general health remained very good. The disease was thought to have reached its climax, it continued for a certain period, to all appearances, stationary, *i. e.*, limited to the deltoid, on either arm; such, however, was not the case. The *atrophy* seized at length on the extensors of the cervical spine, on either side, and on the scalmi and sterno-mastoid muscles; then on the biceps and triceps, including the pectoral muscles, &c. These became one after the other absorbed, giving to the upper part of the body, the neck, shoulders, and upper arms of the patient, a singularly disagreeable, harsh, and emaciated appearance. In this case, as in those quoted by Dr. Brittan from Dr. Reade and Rokitansky, all the structures below the elbow remained normal: in other words, "the forearms and hands displayed the full development of a robust and vigorous man, with all concomitant power, sensibility, and aptitude for use." The treatment consisted of stimulating liniments, blisters, and strychnia, to the affected

parts; and, after a time, of setons; but these did little or no good. Sir B. Brodie was consulted, and advised galvanism, with the internal use of Plummer's pill and tonics. The last time I saw Mr. W— was in 1844; he was then walking in the High Street, Portsmouth, with his head supported by bandages, which embraced his forehead and chest; his hands rested in a kind of loose belt or pocket, which fell on the upper part of the abdomen; he looked tolerably well, and was not in bad spirits. The "muscular atrophy" went on increasing, and, it has been told me, he died *asphyxiated*, in 1847.

With regard to the seat and nature of this rare, and, as it appears to me, fatal malady, it is difficult, indeed, to agree with either Cruveilhier, who says that "muscular atrophy" is due to some primary affection "of the anterior roots of the spinal nerves," or with Dr. Reade, who contends that such cases as that mentioned above "illustrate a diversity of morbid action arising out of disease or injury of some portion of the spinal cord." That each case of *muscular atrophy* is seen in connection with some physical (morbid) change or degeneration of both the spinal cord and the anterior or motive nerves is a matter of demonstration; but the question remains—is such change or degeneration the cause or the consequence of the disease named? Now, I take it, that the affection under consideration presents certain peculiarities in regard, not only to its "localization," but also as to its origin and progress, which negative the idea of its proximate cause being seated in either the cord itself or its nervous trunks. Granting that "muscular atrophy" is independent of any original disease of the spinal system, what more likely than the occurrence sooner or later of palpable changes in both the cord itself and "the anterior roots of the spinal nerves" (Cruveilhier). The mere disuse of the muscular fibre, whether from a mechanical or a vital cause,

would, doubtless, necessitate some alteration of the nerve-tissue entering into the composition of the medulla spinalis &c., and hence the appearances observed, post mortem, by Cruveilhier, Rudolph, Virchow,¹ and others.

It gives me much pleasure to quote the conclusions of Dr. Brittan; they confirm to no small extent my own views. This gentleman writes:

“I should feel great diffidence in suggesting doubts as to the correctness of M. Cruveilhier’s assertions, supported as they appear to be by the observation of the morbid changes, described in the post-mortem examination of the corresponding case, alluded to by Dr. Reade, did I not conceive that the cases now reported bore me out in the supposition that the cause alleged by Cruveilhier is at least not the only cause of this curious disease; but there are many other objections to this theory to which these cases direct our attention.

“It will be observed that in Dr. Reade’s case, and in my own, especially the second, there are several common peculiarities.

“1. The symmetry of the morbid action.

“2. The localization of it to particular groups of muscles; for example, those of the shoulder and humerus, and, to some extent, the biceps; whilst the muscles of the forearm remained affected.

“3. The uniform commencement of the atrophy in the upper parts, and progress downwards. 2

“4. The absence, in each case, of more paralysis than must necessarily be the result of such a degree of atrophy; in fact, it is not paralysis, but loss of power from want of muscle.

“Each of these, independent of all other considerations,

¹ See a Case of Progressive Muscular Atrophy, by R. Virchow, in No. 42 (May 1, 1856) of ‘The Dublin Quarterly Journal of Medical Science.’

appears to me to afford strong objection to either of these alleged causes of the morbid actions. For—

“1st. They require that we assume the anterior spinal roots to be exactly symmetrically affected on either side.

“2d. With a knowledge of the extraordinary complexity of the arrangement of the filaments forming the anterior roots of the cervical nerves, more especially the different distributions and variety of muscles supplied by branches from the fifth, sixth, seventh, and eighth roots, it is almost impossible to conceive atrophy of these anterior roots, affecting only limited groups of the muscles, to all of which these branches proceed; for instance, how can the scapular muscles be affected with paralysis and atrophy, caused by atrophy of the spinal roots, through which their nervous filaments pass, without involving also the phrenic nerve; or of the deltoid and humeral muscles without corresponding affection of those of the forearm and hand, whilst the subscapular, musculo-spiral, and circumflex nerves may be traced through the plexus to the fifth, sixth, seventh, and eighth roots, and the ulnar and median to the same.

“3d. If we allow Dr. Reade's view, that these cases depend on imperfect nutrition, the result of disease of the spinal cord, which involves the influence of the anterior roots—in other words, M. Cruveilhier's theory—we must suppose, to explain these cases, that this function of the cord is so located and circumscribed that disease of its structural instruments may produce its effect without inducing paralysis; or assume (as Dr. Reade states his case proves) that, as the result of organic lesion of the spinal marrow, ‘muscular atrophy may exist without paralysis, as paralysis of motion may exist without disease of sensation or the converse.’

“4th. The absence of complete paralysis in each case, and the proportion between the wasting and loss of power, seem to evidence that the loss of power is more fairly to be

ascribed to want of nutrition and loss of substance, than to loss of nervous energy."

Without doubt, the proximate cause of "muscular atrophy" is located in the ganglionic nerve-tissue, constituting either a centric or an *eccentric* disorder, using these words in their ordinary acceptation. Now, the *nutrition* of muscular structure is dependent on the ganglionic nervous system; and he, only, who denies or doubts this, can be in any position to do else than endorse the foregoing assertion, as to the *seat* of the disease named. Growth and decay, nutrition and atrophy, excess and deficiency of vital power, are severally to be referred to one and the same portion of the human organism; these are effects of but a single cause or principle of action. But this organism undergoes changes, this cause or principle of action undergoes modifications; and hence is it, that *decay*, or *atrophy*, or *deficiency of vital power* become substituted under certain circumstances for growth, nutrition, and excess of power. "There is," writes Bichat, "an animal contractility, and there is an organic contractility." "The one being essentially subject to the influence of the will, has its principle in the brain, receives from the brain the irradiations which put it in action, and ceases to exist when the organs, in which it is observed, communicate no longer with the brain; it participates besides, at all times, with the state of the brain, has exclusively its seat in the voluntary muscles, and presides over locomotion, the voice, the general movements of the head, the thorax, and abdomen. The other has its principle in the moving organ itself, is a stranger to the influence of volition, and gives rise to the phenomena of digestion, circulation, secretion, absorption, and *nutrition*." * * *

The two are quite distinct, both in artificial palsy and in that which is brought on by disease—in *these* the voluntary motions cease; *the organic motions are unaltered.*" The

peculiarity of "muscular atrophy" is (as the expression implies) that the part or parts affected is or are no longer *nourished*, and wasting away lose all capacity to perform their accustomed offices in the animal economy; and the *volition* is necessarily employed in vain on degenerated muscular fibre. The "animal contractility," though intact, is powerless only because its instrument or subordinate parts are wanting. The "voluntary motions" have *not* (*bonâ fide*) ceased, *as* in cases of ordinary paralysis, whether induced by vivisections or "brought on by disease," but (in "muscular atrophy") the "organic motions" (Bichat) *are* altered, *i. e.*, suspended, *dead*.

It need not be insisted on that this *organic contractility* of Bichat is equivalent to the *impetum faciens* of Hippocrates, the *materia vitæ* of Hunter, the *nisus formativus* of Blumenbach, the "irritability," the "motions without force" of the celebrated Haller: and so on.

The foregoing views as to the *seat* of "muscular atrophy" are confirmed by the particulars of a very remarkable case of tumour involving the *first cervical ganglion*. It is reported by Schoenlein; he tells us that the patient complained of *palsy* of the upper extremities, with numbness and tingling sensations; we learn, too, that the action of the respiratory muscles was greatly impaired, and that death resulted from *asphyxia*.

Within a few weeks of the date affixed to this "Introduction," I saw by accident, in the 'Medical Times and Gazette' (No. 325, new series, p. 281), the valuable paper of Dr. Shearman's, entitled 'On Neurosis of the Vagus, an Idiopathic Disease.' In this book I have treated of the same affection under the title of "gastralgia;" the reader will perceive—1st, that the disorder so named is located (see Chap. III), not in the "vagus," but either in the ganglionic nervous tissue entering into the formation of the stomach and primæ viæ, or in the solar ganglion itself; 2d,

that I have ventured to give it as my opinion that such gastralgia (cardialgia) is very much more frequently than otherwise a symptomatic and not an "idiopathic" disorder.

As a primary, *i. e.*, idiopathic affection, Dr. Shearman thus describes it, viz.: "The symptoms of bodily affection are those of lassitude and malaise, most marked in the morning, always less in the evening, and almost completely removed by indulgence in society; a feeling of exhaustion located at the epigastrium, relieved by outward pressure, the ingestion of food and exhibition of stimulants; frequently a sensation of gnawing, tearing, or indescribable uneasiness is added to this feeling of exhaustion; cough, without expectoration; yawning; sighing and nausea occurring between the meals, but never following them; palpitation on the least exertion or annoyance; vertigo, tinnitus aurium, and incomplete direction of muscular effort, with deficient muscular sense; constipation, and free urinary secretion, with dry skin. The whole of these symptoms observe a periodicity, sometimes tertian, at others quotidian; and, under both forms, the period of exacerbation is ante-meridional, almost a perfect immunity existing each evening."

Some two months since I was consulted by a lady (now under my care) for *cardialgia*: this case has more the characters of an idiopathic disorder than I am in the habit of witnessing. The "periodicity" is so well marked that my patient's attention was fixed to it, and she moreover told me that *her sufferings came and went like an ague*. A peculiar feature of the case is that the "roaring" in the head alternates with the strange sensation at the epigastric centre, and which my patient tells me seems to her as if a bladder of air within her kept bursting-like ("b-l-o-o-p-p," to employ her own simile); and that both the cerebral and stomach symptoms appear not unfrequently to be kept in abeyance by a troublesome and painful (neuralgic) dryness and itching

about the body and the extremities. The treatment consisted in the local application of chloroform, tincture of aconite, &c., with the internal use of quinine and Liq. Potass. Arsenitis. The Hyd. c. Creta, c. P. Rhei co., c. Ext. Hyos., were given nightly. Some relief followed this treatment, and then all medicines were discontinued for a time. When my assistance was again solicited, I prescribed the Argent. Nit. c. P. Opii bis die, with a solution of quinine (acidulated) every six hours. Last week only, acting on the suggestion of Dr. Shearman, I changed the quinine for Liq. Potass.; and such is the treatment pursued at this moment. To render the foregoing recital complete, it should be added that my patient derives much temporary relief from the use of a mixture containing Tr. Valerian. Ammon., Tr. Opii Camph., and Chloric Æther, ex Mist. Camph. and Aq. Menth. sat.

I believe the profession is indebted to Dr. Shearman for two facts in connection with *gastralgia*, alias “neurosis of the vagus.” One is the alkalinity and the saccharine character of the urine, the other is that “one-drachm doses of Liq. Potass. reduces the sugar in the urine, and renders the latter acid in this disease;” and is therefore of much value as a remedial means: I conclude this on the authority of Dr. Shearman himself.

The issue of two cases of this peculiar affection *now* under my care—that one above given, and another in the person of a wealthy tradesman of Bristol too earnestly and unremittingly occupied within doors, and who pays the penalty in, as he says, “a dreadful sinking at the stomach and faintness,” &c.,—might put it in my power to practically verify the *value* of this medicine (Liq. Potass.) The latter patient I saw but some ten days since; and he is, at this time, greatly better, although his indisposition is of “two years’ ” standing, and this in spite of much advice.

It appears from the remarks of Dr. Chambers (see his

book entitled 'Digestion and its Derangement') that he considers that the source of power (vitality) to the stomach and intestinal canal is "the sympathetic system;" and that whatever diminishes its tone or exhausts its energies impairs, at the same time, the "peristaltic wave of the alimentary tube," and induces, therefore, *indigestion*. Nothing can be more certain than that what is called *atonic dyspepsia* is to be referred to an altered or abnormal condition of the *ganglionic nerve-tissue* entering so largely into the formation of the *primæ viæ*; and for the relief of which galvanism is, it appears to me, not less plainly indicated than it is in ordinary *paralysis, i. e.*, diminished power of what are called the voluntary motions. Strychnia, or what is much the same, Extr. Nuc. Vomicae, is of great value in *atonic dyspepsia*; in combination with aloes, the operation of this, or of any other drug, is more certain and effective.

"The sympathetic system" (Chambers) may be affected, *not* by a deficiency of nervous *energy*, but by an excess of it; and the "peristaltic wave," peculiar to the stomach and intestines, may *not* be reduced to too low an ebb, but may suffer from an irritable and continuous action. Now, *morbid sensibility*, occurring to the organism which forms the great alimentary tube—the *primæ viæ*,—may be indicated in various ways by, it may be, "neurosis of the vagus" (Shearman), by *gastralgia*, or by "irritative dyspepsia" (Golding Bird), by "obstinate dyspepsia and vomiting of food" (Sibson), or "difficult stomach" (Sir J. Eyre); however, by whatever *name* recognised, we shall find that the most certain remedies are silver—the *nitrate* or *oxyde*—and opium. Provided the secretions are in a healthy state, and the bowels are regular and duly evacuated, I know of no medicines, tonic or sedative, at all equal to these as *anti-dyspeptics*.

In the autumn of last year the wife of a farmer, some

miles from hence, was brought to me. She had been ill two years; and during the whole of this period she had suffered from attacks of acute pain in and about the abdomen (gastrodynia). These occurred several times each day, and almost invariably after she had eaten. The pain continued until she vomited; a large quantity of offensive fluid matter, mixed with semi-digested food, was ejected from the stomach. Appetite good, more or less thirst, bowels regular, and motions healthy-looking; she made very especial complaint of constant and distressing *flatus*. The urine was abundant, of a pale colour, and slightly alkaline. This patient had been under the care of gentlemen of the best eminence at Clifton, but had derived no permanent relief. She was restored to perfect health after some six or seven weeks, under the use of pills composed of Argent. Nit. and P. Opii through the day. She took each night a small quantity of Aloes with Ext. Hyoscyam. and Hydr. c. Creta; an opiate plaster was worn over the epigastrium, and to which more particularly she seemed to attribute her well doing. I had almost forgotten to mention, that some eighteen or twenty months before this person came under my care and treatment, she was attacked with profuse hæmatemesis.

The recital of a very interesting case of "irritative dyspepsia" (G. Bird), which it appears was cured with *opium* principally, is contained at page 254 of Dr. Bird's 'Urinary Deposits.' The bowels being confined, and the urine surcharged with "flesh-coloured urate of ammonia," complicated somewhat the treatment.

At page 82 of the 'British Medical Journal (Jan. 31, 1857) there is recorded another case of "morbid sensibility" of the stomach and intestinal canal, under the title of "obstinate dyspepsia," &c. Dr. Sibson cured his patient by Arg. Nit. c P. Opii.

I should never have thought it necessary to even allude to my own case of the farmer's wife, whom I saw in the autumn of last year, had I not noticed the remarks of Dr. Sibson's reporter (T. H.)

That Sir James Eyre has done good service to the *dyspeptic* by his warm recommendation of the *Argent. Oxyd.* cannot be doubted, however much the late Dr. James Johnson may have anticipated his (Sir J. Eyre's) publication, viz., 'The Stomach and its Difficulties.' If this gentleman has not seen Johnson, 'On Morbid Sensibility of the Stomach,' he will perhaps excuse me for calling his attention to an invaluable book.

That the attention of the profession is being yet more and more directed to the physiology and pathology of the ganglionic nervous system is most certain. It gives me pleasure to refer to a paper in the 'Dublin Quarterly Journal,' from the pen of Professor Osborne, "On Exhaustion of Nervous Power in the Solar Plexus." The symptoms detailed are, strange to say, very much like those which Dr. Shearman has enumerated as belonging to "neurosis of the vagus." Dr. Osborne gave chloroform, in doses of twenty drops, thrice daily; the patients, three in number, were speedily relieved, and ultimately cured.

Dr. Lees, too, has written, in the 'Dub. Hosp. Gazette,' "On Epigastric Neuralgia." The sensation, or rather pain, at the epigastric centre is described as acute, continuous, and "occupying a space not above the size of a five-shilling piece." The presence of "minute crystals of oxalate of lime" in the urine leads one to suppose that the case recorded was *not* one of an idiopathic kind, but one complicated with dyspepsia in some form or the other. The patient was cured by taking Inf. Valerian., Inf. Cinchonæ, aa $\mathfrak{z}$ ij;— $\mathfrak{z}$ j ter die; by blistering the epigastrium, and by the application

afterwards of Unguent. Acet. Morph. (gr. j. ad ʒj). Dr. Lees very judiciously draws the distinction between such nervous affections and *hysteria*; a word too loosely adopted by the profession, or I am greatly mistaken.

J. G. D.

NORTHWOODS, BRISTOL;

May 15, 1857.

THE
GANGLIONIC NERVOUS SYSTEM,
&c. &c.

CHAPTER I.

THE STRUCTURE OF THE GANGLIONIC NERVOUS SYSTEM.

THE direct object I have in view, in the composition of the following pages, is, as the title-page informs the reader, a demonstration of the several functions exercised by the *ganglionic nervous system*. This book is *physiological* rather than *anatomical*; however, I have thought it necessary to the entirety of the subject of which the following pages treat, and necessary moreover to the easier comprehension of the views herein unfolded, to prefix some general remarks on the *anatomy* of the sympathetic nerve. "The peculiarities of its structure" (Todd and Bowman) would, *à priori*, lead one to associate the same with a specific office in the animal economy. The ganglionic nervous system, we are told by writers who entertain no exceptional or especial views concerning it, "comprehends a great subdivision of the nervous system, which presents certain peculiarities of structure, and of distribution, whereby it is strikingly contrasted with the cerebro-spinal nervous system."

Anatomists are in the habit, in treating on either the cerebral or spinal system of nerves, to commence with their respective centres, viz., the brain or spinal cord. I will, therefore, in treating of the sympathetic nervous system, mention, in the first place, its *centre*, viz., the *solar plexus*—"the sun of the abdominal sympathetic system" (Todd and Bowman). The solar plexus, the centre of the "cyclo-ganglionic system"¹ (Solly), is described as a gangliform circle, enveloping the cæliac axis. From this "gangliform circle" branches pass off in all directions, like rays from a centre. It gives off distinct filaments which accompany, under the name of plexuses, all the branches given off by the abdominal aorta. Thus we have derived from the solar plexus, the phrenic plexuses, the gastric, hepatic, splenic, supra-renal, renal, superior mesenteric, and spermatic plexuses; also the inferior mesenteric plexus.

However, the principal branch or rather division of the solar plexus is the great splanchnic. It arises from the upper and back part of the organ, and proceeding upwards pierces the diaphragm immediately to the outer side of each crus, ascends in front of the vertebral column, within the posterior mediastinum, and terminates by dividing into five branches, which severally proceed to the sixth, seventh, eighth, ninth, and tenth dorsal ganglia. By referring to an engraving of the sympathetic nerve the anatomical connections of the ganglionic with the spinal nerves throughout the entire length of the cord will be distinctly made out. It is seen that each of the several ganglia, whether cervical, dorsal, or lumbar, gives off com-

¹ "It has appeared to me," writes Mr. Solly, "that in describing this portion of the nervous system in man, it would be better to designate it the *cyclo-ganglionic* system, as corresponding in its mere anatomical arrangement with the nervous system of the cyclo-gangliated or molluscos division of the animal kingdom."

municating branches with the individual spinal nerves, thus uniting the two systems. The pelvic viscera and the lower extremities are supplied with their organic or ganglionic nerves from the hypogastric plexus and sacral ganglia.¹

The union of the ganglionic and spinal nerves, as is here demonstrated, would in itself be sufficient to establish an indissoluble connection between the former and the cerebrum and its nerves. They have, however, a more direct communication, by means of the ascending or carotid branch of the superior cervical ganglion; which, having entered the

¹ At p. 223 of Todd and Bowman's 'Physiological Anatomy,' are these words, viz.: "The connection of the sympathetic system with the brain and spinal cord appears to take place through the cerebro-spinal nerves. Certain filaments connect each spinal nerve to some portion of the ganglionic chain which lies on each side of the spinal column. And a similar connection takes place between the ganglia of the cephalic portion of the sympathetic and the encephalic nerves, of which the following may be cited as well-known instances: the third nerve is connected with the ophthalmic ganglion; the sixth with the superior cervical ganglion; the fifth nerve with the sphenopalatine and otic ganglia. These connecting filaments have been called the roots of the sympathetic; and thus this nerve has been represented as taking an extended origin from numerous points of the cerebro-spinal centre. This is true; but, in dissecting the connection between the sympathetic and the spinal nerves, we find that, for the most part, two distinct fascicles connect them, one of which is white, being composed of tubular fibres; the other is gray, and consists of gelatinous fibres. The former seem evidently cerebro-spinal fibres, which pass to or from the periphery conjoined with the other elements of the sympathetic; but, in the present state of our knowledge, it is difficult to form a correct idea as to the precise object of the latter bundles, or as to the central connection which they form, whether with the ganglion on the posterior root of each spinal nerve, or with the spinal cord. That the sympathetic has intimate and extensive connections with the brain and spinal cord, is abundantly proved, not only by the anatomical statements above detailed, but by the circumstance of which every one is conscious, that pain may be excited in parts supplied from this system of nerves alone, as in the intestines; as well as by the fact, that irritation of the spinal cord may produce contraction of muscles which derive their nerves from this source, and that destructive diseases of that organ may occasion paralysis of those muscles."

carotid canal with the internal carotid artery, divides into two branches, which form several loops of communication with each other around the artery; and these constitute the *carotid plexus*. Now, the carotid plexus is the centre of communication between all the cranial ganglia; and being derived from the superior cervical ganglion, between the cranial ganglia and those of the trunk. It also communicates with the greater part of the cerebral nerves, and distributes filaments with each of the branches of the internal carotid, which accompany them in all their ramifications.¹

As each of the cranial ganglia, moreover, communicates freely with the cerebral nerves distributed about the head and the face, exteriorly and interiorly, it follows that nothing more is required to establish the strict and efficient anatomical connection between the ganglionic and the cerebro-spinal nervous systems. I may add, nevertheless, that the pneumogastric nerve or vagus—by being distributed to the respiratory and digestive apparatus and the heart, where it forms communications with the organic or vital nerves, as well as with the solar ganglion itself, by means of a small branch, which is represented in plate xix of Mr. Wilson's work before quoted, as being given off by the principal trunk, where it turns forward to be lost on the anterior surface of the stomach—yet more effectually secures the relationship between the brain and the solar ganglion, the centres of their respective systems; whilst the phrenic nerve, in being formed by the union of filaments from both the cervical and sympathetic nerves, and in being also distributed to the diaphragm, provides for the same end.

A comparison of the solar ganglion, cerebrum, and spinal cord with each other, regarded as the centres of their respective systems, will reveal much that is important and interesting—apart from the mere external and physical

¹ See Wilson's 'Practical and Surgical Anatomy.'

characteristics of the two latter named—by which I mean the circular, or hemispherical, or elongated forms of the brain and spinal cord. The abundance of gray matter in the first, viz., the solar ganglion, and its peculiar admixture with the white substance entering into its composition, contrast strangely with that (the gray matter) of the cerebrum and spinal cord, and particularly in so far as its seeming relationship (functional) to the white or fibrous substance is concerned.

The nervous tissue belonging to, or rather which constitutes the ganglionic, is, in fact, *greatly* dissimilar to that of the cerebro-spinal system. Bichat has the credit, I believe, of being the first to mark their peculiar characteristics, and to specify their individual qualities, if he did *not* go yet further. Mr. Solly says, that he (Bichat) arranged the functions, like many of his predecessors, under two heads; but instead of referring the power which appears to regulate and preside over these phenomena to some mysterious spirit, he considered it to be dependent for its very existence on the nervous system; and this led him to divide the nervous material (nervous tissue) “into two systems, the one of which he called the nervous system of organic, perhaps better called vegetative life, and the other of animal life.”

It is only in the higher order of animals that this same nervous material, or “nervous tissue,” exists uniformly; and in these only is it divisible into two varieties, viz., the ganglionic, or that constituting the system of the great sympathetic nerve; and the cerebro-spinal, or that constituting the brain and spinal cord, and the nerves immediately connected with them.

The two nervous tissues, or rather “varieties,” remarks Dr. Fletcher, in his ‘Rudiments of Physiology,’ become more or less incorporated together, as they proceed each from their central parts. Both consist partly of a gray, and partly of a white substance, opaque, pulpy, and inelastic; the gray

matter being always apparently homogeneous in its structure, the white *sometimes* apparently homogeneous, at others obviously fibrous; and both supplied by a fibrous membrane, called neurilema; which in the apparently homogeneous nervous substance is plexiform in its structure, and in the fibrous, tubular. Between the two varieties of the nervous tissue the principal distinctions are that, in the words of the late Dr. Fletcher—

“In the ganglionic nervous tissue—

“The gray and white substances are everywhere—as well in the minutest nervous filament, as in the largest ganglion—inextricably interwoven together;

“The white matter is always apparently homogeneous; and

“There is found upon analysis very little oleaginous matter, but some fibrin.

“In the cerebro-spinal nervous tissue—

“The gray and white substances are always separated by a decided line of demarcation, and the former is found only in the central parts of the system;

“The white matter is in some nerves—as in those belonging to the respiratory and motiferous systems—obviously fibrous; and

“There is found upon analysis much oleaginous matter, but no fibrin.”

The above organic peculiarities of the ganglionic and cerebro-spinal nervous tissues, I may here remark, *en passant*, are of the highest physiological import. Whilst in the first named, it will be remarked, the admixture of the gray (*gelatinous*) and white (*i. e.*, tubular or fibrous) substances, gives to its several parts, or ganglia, a certain independence of power and action; in the second, the distinctness of the two, *i. e.*, the gray and white substances, renders

the same a matter of perfect impossibility.¹ When commenting on the abundance of gray matter which is contained in "a ganglion," Dr. Fletcher says that it is always, wherever found, a primary source of some distinct faculty or

¹ The following words from the pen of Dr. Carpenter, ascribe more to the *form of the ultimate structure* of portions of the nervous system, than to their mere colour. "The second primary element of the nervous system, without which the fibrous portion would seem to be totally inoperative, is composed of nucleated cells, containing a finely granular substance, and lying somewhat loosely in the midst of a minute plexus of blood-vessels. Their original form may be regarded as globular (hence they have been termed *nerve-* or *ganglion-globules*); but they often present an extension into one or more long processes, which gives them a *caudate* or a *stellate* aspect. These processes are composed of a finely granular substance, resembling that of the interior of the vesicle, with which they seem to be distinctly continuous; and if traced to a distance they are frequently found to become continuous with the axis-cylinders of the nerve-tubes. Besides the finely granular substance just mentioned, these cells usually contain a collection of pigment-granules, which give them a reddish or yellowish-brownish colour. This, however, is frequently absent, especially among the lower animals. The size of the vesicles is liable to great variation; the globular ones are usually between $\frac{1}{300}$ th and $\frac{1}{1250}$ th of an inch in diameter. The substance, which is made up of these peculiar cells, of the plexus of blood-vessels in which they lie, and of the granular matter that is disposed amongst them, is altogether commonly known as the *cineritious* or *gray* substance; being distinguished by its colour, in man and the higher animals at least, from the *white* substance (composed of nerve-tubes), of which the trunks of the nerves, as well as a large part of the brain and spinal cord, are made up. But this distinction is by no means constant; for the gray colour, which is partly due to the pigment-granules of the cells, and partly to the redness of the blood in the vessels, is wanting in the Invertebrata generally, and is not characteristically seen in the classes of fishes and reptiles. Moreover, when the ganglionic substance exists in small amount, even in man, its colour is not sufficiently intense to serve to distinguish it; and, as we have already seen, there are nerve-fibres which possess a *grayish* hue. The real distinction evidently lies in *the form of the ultimate structure*, which is *fibrous* in the one case, and *cellular* or *vesicular* in the other; and these terms will be henceforth used to characterise the two kinds of nervous tissue, which have been now described." At p. 212 of Todd and Bowman's 'Physiological Anatomy,' the reader will find a graphic description of *the vesicular nervous matter*, illustrated by woodcuts of much value and interest.

power. He has these words: "It is probable that no impediment whatever is offered to the function of a ganglionic nerve by such a division as entirely paralyses the cerebro-spinal. Such is the case with the latter only because the white matter of the nerve being dependent for its energy upon the gray matter of the central parts of this system, becomes of course inert when separated from it: but no such line of demarcation exists in the ganglionic system, every point of every nerve of which contains white and gray matter intimately interwoven together, and may be considered therefore as a centre of nervous energy to itself; and it is in this way only that we can explain how the total removal of a muscle from the rest of the body, which implies a division as well of its blood-vessels as its nerves, is not for some time effectual in destroying its irritability."

When, in the course of these pages, I shall have to treat of the many and important functions of the ganglionic nervous system, it may strike the mind of the reader that its mere bulk is hardly compatible with the offices claimed for it, in the animal economy; however, this objection as regards the mere quantity of nervous tissue is rather apparent than real. It is an admitted fact, that the minute ramifications of the ganglionic nervous system constitute its chief bulk, and that these are so numerous and plentiful, that it would be impossible to insert a pin's point into any portion of the body without wounding or destroying very many such. So universally and so copiously is the ganglionic nervous tissue distributed, that, like the parenchymatous tissue, it is interwoven with every portion of the organism; and more even than this, constitutes a great part of the volume and weight of the whole body.

The eye may not always discover the aforesaid "minute ramifications," *i. e.*, filaments of the ganglionic nervous system; but their presence may with the greatest certainty

be predicated. It is a distinguishing feature in the character of the ganglionic system of nerves, that its filaments are everywhere small, and in many parts so minute as to be altogether invisible; and hence, not only was the system in general comparatively very late in being discovered, and much later in being generally admitted by physiologists, but the existence of some parts of it has been, in recent times, denied; as already stated: even in organs in which the filaments are much less obscure than in many others.¹

I may here remark, that till within a short period, it was the custom to look on everything like a nervous system in the lower order of animals as belonging exclusively to a cerebro-spinal system, or to an *analogue* of the same, or of one or other of its parts; but now-a-days, when the "cyclo-ganglionic" (Solly) system is being better understood, and its physiological importance more duly recognised by the profession, this exclusive opinion no longer obtains; and authorities are, day by day, becoming less divided in opinion as to which of the two systems—the cyclo-ganglionic or the cerebro-spinal—the nervous apparatuses of the lower orders of animals ought to be referred.² Moreover, it is now very generally believed that where a distinct nervous system is present, and there is an evident separation of the *animal* from the *organic* or vegetative functions, there, in all probability, are two corresponding nervous systems incorporated, so to speak, viz., a cerebro-spinal and a cyclo-ganglionic; and on the other hand, where there is no evident separation of the animal from the organic or vegetative functions, or, in other words, where there is a distinct nervous system present, and this is indicated by and associated with "vegetative functions" only, there is then but one corresponding nervous organism, and this one is the "cyclo-ganglionic."

¹ Soemmering.

² See Solly, 'On the Human Brain,' 1836.

I may here add that it does not follow that, because the nervous tissue is not "distinct" in the lowest classes of animals, the same is altogether wanting. I cannot doubt that its existence is ever to be inferred from the presence of the aforesaid organic or vegetative functions. "Though it is difficult," writes Mr. Solly, "most probably on account of its minuteness, in many of the lower animals, to demonstrate the existence of the nervous system of vegetative life, as distinct from that of animal life—there is very little doubt that it always exists;¹ and it has, in fact, lately

¹ The annexed passage from Mr. Solly's work 'On the Brain' does not quite accord with the few words quoted in the text; however, I cannot doubt that Mr. Solly is at this time not less fully assured than myself, that *nervous matter* is as indispensable to the integrity of the functions "of vegetative life" as it is "to the manifestations of consciousness." At p. 34 we read thus, viz.: "In directing our attention to the relation which the development of the nervous system bears to the manifestations of consciousness in each individual of the animal kingdom, it is interesting to observe the relative position which the nervous system, in its simplest form, holds to the alimentary canal: we must not, however, attempt to account for this circumstance by supposing that the presence of a nervous system is necessary to the solution, digestion, and assimilation of the alimentary matter; for these processes are perfectly executed by the fresh-water polypus, or *Hydravipidis*; in which there is not the slightest trace of a nervous system. Almost the whole existence of the lowest orders of animals appears devoted to the acquirement of food and reproduction of their species; apparently they answer no other end in creation than that of elaborating a nutrient material for others that hold a higher rank in the animal kingdom; and the whole of their vital energies being devoted to this object, we cannot be surprised that those organs which are expressly constructed for its fulfilment should be surrounded by, and thus intimately connected with, that system (the nervous) by which the animal is informed of the existence of surrounding things, and is fitted to act upon these to the extent of its limited necessities."

Dr. Carpenter tells his readers "that wherever a 'nervous system' can be detected, a conscious mind must be connected with some part of it," as if a *nervous* structure *could* have nothing else to do in the animal economy but minister or contribute to the mental operations. The anatomy of the brainless monstrosities recorded by Mr. Lawrence and others, is an apt and eloquent reply to the theory of Dr. Carpenter, which refuses to an *isolated* "nervous system" the

been demonstrated in many of the lower orders of animals where its presence was not previously even suspected." Dr. Grant corroborates the foregoing opinion of Mr. Solly, in the following few words, viz. : "The nerves of sensation and motion closely accompany each other, forming by their union cords or columns, or a cerebro-spinal axis; but the sympathetic nerves, appropriated to the more slow and regular movements of organic life, form a more isolated system; and these three systems are developed together" (?) "almost from the lowest animals."

I once met with the following sentence, but in what book, or where, I have quite forgotten : "Without a *nervous* system there is no animal—there can be none; without a *circulating* one there are myriads." And this remark is excellently well confirmed by Mr. John Anderson, in his learned and admirable 'Sketch of the Comparative Anatomy of the Nervous System,' published in 1837. Mr. Anderson assumes that all animated nature has a certain definite point at which it commences, that there is a sort of central commencing point which expresses the primarily created form of organic and inorganic matter; that form being a sphere, and that sphere being capable of conversion into other forms characteristic of the vegetable and the animal kingdoms. Whether this position be true or false, we cannot but be impressed with the following facts :

1st. That there is a great similarity both in the external form and in the internal structure of the first specks of development of all grades and states of organized matter.

2d. That the lowest permanent forms of these states of organized matter bear a great resemblance to each other.

3d. That the highest forms of organic matter commence their career of development by the simplest and primary qualities necessary and indispensable to the integrity and continuance of the vegetative functions not less than to the excito-motory phenomena.

form, at the same time agreeing greatly in character with the permanent condition and form of the lowest organized matter.

Now the inevitable conclusions from the foregoing facts must be, as insisted on by Mr. Anderson, that *man*, the essence and perfection of organic life, must have a like beginning to the monad—that there must be a time when *he* (*i. e.*, man) exists only as a globule (cell) of elementary matter. Man and the monad must have a similar starting point; the development of the one, however, is almost immediately arrested; the development of the other proceeds rapidly in its career, and arrives at last at what we conceive to be the type and essence of animal perfection. The *Polygastrica* and *Porifera* are mentioned by Mr. Anderson as affording, by their peculiar organism, a good illustration of his position. These animals appear as a *punctiform homogeneous mass*, in which a nervous system does not as yet exist in a distinct form; nervous *globules* (cells) are, however, everywhere diffused through the cellular tissue of their body.

The peculiar susceptibility of the *Actiniæ* would doubtless indicate no slight degree of “nervous sensibility,” but which, as Mr. Anderson remarks, “in the present state of our knowledge we can only conceive to be afforded by *nervous globules* (cells) distributed in their homogeneous structure—similar to the *Polygastrica* and *Porifera*.”

Now what is the human ovum, when first detected, more or less than a *punctiform homogeneous mass*—a globule? “It is of that form which has been presumed to be the primary one of all organic matter.”

It would seem that the descriptions given by Tiedemann, Blundell, and Howe, of the early embryotic life (human) will each of them apply equally well to that of the lower animals. The early *embryo* of the squirrel, the common fowl, and the frog, have been carefully and minutely exa-

mined, and each one of these are proved to be precisely alike, consisting of a mere "spherical globule" or "vesicle."

I am quite disposed to agree with Mr. Anderson, that "man and many of the lower animals begin their career of development by an albuminous globule, similar to the pulpy spherically formed acrita; that in their very early embryo state the nervous, equally as in these lowest animals, does not exist yet as a particular system; that it consists, as in them, probably only of globules diffused through their minute homogeneous mass." It is in the next group of animals, viz., the *Radiata*, that nervous filaments "are for the first time discoverable;" and, according to Mr. Anderson, such are formed by "a longitudinally-arranged series of nervous globules." Nor is this all, the "form and direction" which these "nervous globules" assume, their relative position, means of communication, &c., go to prove that they constitute nothing more or less than a "ganglionic" system, the "nervous system of vegetative life." When treating of the organism of the star-fish, Mr. Solly writes thus: "In this individual all the ganglia are of equal dimensions, none predominating in size over, or differing in function from the rest; there is no concentration of power, all is equally diffused."

The reader will recognise this as constituting the very essence of the "cyclo-ganglionic system."

In proportion as we carry our investigations upwards through the ascending scale of creation, we find that the nervous system becomes more and more highly developed and complicated. Thus, whilst in the "*Asterias*" the nervous system constitutes a mere ring, "a collar around the anterior part of the body" (Grant), in the *Mollusca* it is marked by the presence of a distinct *centre*, "central medullary mass" (Anderson), which may not inaptly be considered the *analogue* of the great *solar ganglion* in man and the *quadrumina*.

It is, moreover, in the Gasteropeda (a molluscous animal) that "the nervous system acquires a greater degree of concentration in the head." The "primary nervous ring develops a ganglion situated above the œsophagus, and consequently on the dorsal aspect of the animal." In the limpet Mr. Anderson discovered that the same "ganglion" gave off filaments to the eyes and tentacula; other nervous filaments were seen to pass "to the foot and the circular muscle and mantle."

We learn on further investigation that this *concentration* of nervous matter in the head, *i. e.*, above the œsophagus, and on the dorsal aspect of the animal is yet more palpable in the whelk than in the limpet, that the same is found in still greater quantity in the snail and slug; and in the *Doris* there is a ganglion developed above the œsophagus, which is of immense size compared to the two small ones which are below it. From the position of these concentrations of nervous matter, *i. e.*, ganglia, in the several animals named, and not less from the direction and termination of the many filaments mentioned, I cannot doubt that they—the ganglia—must be regarded, in each of the instances cited, as the *analogue* of the medulla oblongata in man and the quadrumina.¹

¹ "If we attend to the functions of the organs on which the chief nerves of the avertebrated tribes are distributed, we shall not hesitate to believe that they are analogous, at least equally to the cerebro-spinal system as to the ganglionic. The nervous collar just alluded to, as the first visible trace in animals of a distinct nervous system, ministers directly to the action of swallowing, and thus corresponds, perhaps, not so much to the lower maxillary branch of the trigeminis nerve—in its motiferous and sensiferous filaments—as to the glosso-pharyngeal nerve of the higher classes of animals, round the pharynx and gullet of which, in fact, a similar collar is formed by the nerve in question; although, from the comparative complexity of the parts, it is less immediately obvious. The first visible nerve then is a branch of the cerebro-spinal system. It is certain, likewise, that most avertebrated animals send nerves directly to other organs, as well of sympathetic and instructive motion, as of voluntary motion and sensation;

Passing on to the *cephalopoda*, "the highest of the mollusca," we find that "the oval primary nervous ring develops a large ganglion above the œsophagus, a completely lobed mass or brain, which differs from all the other classes in being situated in a cartilaginous case, an organized cranial cavity; from it issue the nerves, and there are no other ganglia developed on the primary nervous ring." Mr. Anderson assures us, too, that in the *sepia officinalis* he has found a concentrated lobate nervous mass, situated above the œsophagus, and contained in a rudimentary cranial cavity—a cartilaginous case. "This then," remarks Mr. Anderson, "is the first appearance of a medullary mass corresponding to a *brain*; and from it arises the optic nerve, already of large size."

As may be expected, it is in the molluscous group that so interesting and wonderful transitions of the nervous matter take place. I cannot but look on the mollusca as the material, so to express myself, whereby the "acreta," and *acalepha* (provisional), *Polyphera*, *Porifera*, and *Polygastrea*, and the "Radiata," including the whole of the *Echinodermata*, are, as it were, linked, through the intervention of the "articulata," with the *vertebrata*, and even with man himself.

In the molluscous group, *i. e.*, in the *gasteropoda* and

the star-fish (*Asterias*), for example, to the tentacula; the mussel (*Mya*) to the muscular cloak-bag; the cuttle (*Sepia*) as well to the cloak-bag as to the tentacula, eyes, and ears; the garden-snail (*Helix*) to the muscles of the neck and of locomotion, as well as to the eyes and feelers; the sea-mouse (*Aphrodita*) to the tentacula; the cray-fish (*Cancer*) as well to the muscles which move the plates of horn which surround the gills, as to the antennæ, legs and tail, the nostrils, eyes and ears; the silk-worm (*Phalenæ*) to the moveable stigmata and the muscles of the head, the feet, wings and eyes; the bee (*Apis*) to the feet, wings, and eyes—and so forth; and such nerves must accordingly be presumed to correspond, not to the ganglionic, but to the cerebro-spinal system of the superior tribes." (Fletcher's 'Rudiments of Physiology,' pp. 79, 80.)

cephalopoda, we not only perceive the nervous system of vegetative life in active operation, but we see also an evident effort and intention on the part of nature to add to her enjoyment; tired, as it were, with the comparatively limited resources at her command, and earnest in the adaptation of means to an end, she provides the first-named class of animals with an especial organism, the *supra-œsophageal ganglion*, *alias* the *medulla oblongata*, by means of which she establishes a direct relationship with the external world; whilst the possession of certain external nerves is an important item in the integrity of the animal itself, and raises it very materially in the scale of creation.¹

Nature, yet more liberal to the second, viz., the *cephalopoda*, provides it not only with what may be called a rudi-

¹ "In the *cyclo-gangliata* or *Mollusca*, where we find the organs of sense and the external form sacrificed, as it were, to the more perfect development of the organs of vegetative life generally, and of the digestive and circulating systems in particular, the nervous apparatus is commonly found scattered in an irregular manner throughout the interior of the animal. * * * The supra-œsophageal ganglion is connected with two lateral ganglia, and there is, in addition, a fourth ganglion beneath the bulb of the œsophagus. From the right lateral ganglion there is a considerable nerve detached, which descends towards the heart, near which organ it becomes connected with a fifth ganglion, from whence branches are given off to the heart, and to the organs of digestion and of generation in its neighbourhood. This ganglion and its branches are evidently analogous to the sympathetic or vegetative system of nerves in man and the higher animals.

"From the supra-œsophageal or cerebral ganglion nerves are given off to the muscles of the head, and to the superior tentacula and eyes; while the branches from the lateral ganglia are distributed to the muscular parietes. In this form of nervous system we must not neglect to remark the curious mode in which the nervous system of organic or vegetative life is bound up with that of animal life; so complete, indeed, does this connection appear to be, that we cannot decidedly point out the distinction, if there be any, between the centres of power and the conductors of the two systems; in other words, and as we should say in the ordinary language of human anatomy, the line of demarcation between the ganglionic system and the cerebro-spinal system is nowhere clear and well defined among the *cyclo-gangliata*." (Solly.)

mentary spinal system, but with a "cerebral ganglion," divided into anterior and posterior lobes, similar to the tub-quadrigenina of the mammalia. Mr. Anderson calls this same "cerebral ganglion, the first lineament of that cerebral mass which may be traced through successive complications to the perfect brain of the human species." From what has been already advanced, it will appear that the cycloganglionic nervous system takes precedence of both the spinal and cerebral, or, in other words, that the sympathetic nerve enjoys an existence long anterior to either the spinal cord or the brain; and that this fact holds good throughout the whole of animated nature, from one extreme link of the very lengthened chain of being to the other—from the first to the last created atom—from the zoophyte to man. The force and importance of the annexed quotation from the very able and learned volume of Mr. Anderson must excuse its length; no words of my own could convey so much: "I have already noticed the early human ovum before any embryo was apparent, and have pointed out the analogy existing between it and the seed of plants, the lowest infusoria, the monads, &c. I have also spoken of the early embryo itself as a minute, spherical, homogeneous mass, where the nervous system was supposed to be molecular, as in the acrita, the lowest truncata, and the lowest entozoa. As the embryo increases in development, nervous filaments are discovered formed, as we conceived in the radiata, by a longitudinally arranged series of globules; these nerves, doubtless sympathetic ones, are then formed before the spinal cord and brain, and previous also to their communication with those two organs; which phenomenon Tiedemann considers best explained by the general law of organization laid down by Serres, viz., that the development of the nervous system proceeds from the circumference to the centre. This again quite agrees with its development according to the laws of

philosophical anatomy, as laid down by Carus. Now, on reflecting on the state of the nervous system of the animals already described, we find that filaments exist in many of them, without any approach to the character of a spinal cord—a mere ganglionic sympathetic system.¹ Arrived, however, at the articulata, a longitudinal arrangement of closely approximated ganglia is observed, forming a double nervous cord, extended along the ventral surface of the animal, at the upper extremity of which, on the dorsal aspect, a cerebral ganglion is developed. This is highly interesting, from the similar rudimentary condition of similar parts in

¹ At page 75 of Dr. Fletcher's 'Rudiments of Physiology,' we find these words, viz.: "As far as regards the earlier appearance, as we rise in the scale of animals, of the ganglionic than of the cerebro-spinal system of nerves, this argument in favour of regarding the former as the immediate seat of irritability, is probably well founded, if it signify merely that we are to look upon the minute nervous nodules which first display themselves in animals, forming, as it were, a connecting link between those which present no traces whatever of nervous matter and those which have a regular nervous apparatus, as appertaining rather to the ganglionic than to the cerebro-spinal system of the superior tribes; but not if it compel us to regard—as some physiologists have done—the more or less concentrated nervous systems of all the avertebrated animals as corresponding merely to the ganglionic system of the vertebrated. Wherever a distinct nervous apparatus exists at all, whether in an avertebrated or vertebrated animal, that apparatus seems to correspond to both a ganglionic and cerebro-spinal system, and not exclusively to either; and the only difference between such an apparatus as found in the avertebrated, and as found in the vertebrated animals, appears to be that the main portions of the two systems of which it consists, are not, in the former, separated from each other by a distinct spinal column and skull, but directly incorporated together; whereas in the latter they are so separated, and connected with each other only by reciprocal filaments interposed at certain intervals. The only means, short of any positive evidence of its correspondence with one or other of these systems, of determining the character of the apparently simple nervous apparatus of the avertebrated animals appears to be by observing—1st, the general aspect and relative size of this apparatus; 2dly, the situation of its principal departments; 3dly, the functions of the organs on which it is distributed; and, lastly, the effects of direct experiment upon it."

the human embryo ; the brain and spinal marrow, the first visible rudiments of which (according to Tiedeman) appear between the fifth and sixth week, in the form of a whitish vesicular fluid, contained in a membranous canal or tube in the trunk leading to or forming a cavity or pouch in the head. At the seventh week the spinal cord is large and thick, the rudiments of the two lateral columns of which are manifested in the form of a simple pulpy streak,—a nervous streak, greatly similar to what I have described in the *Ascaris* amongst the Entozoa ; at the upper extremity it forms, or is contiguous with, a mass of medullary matter, the most developed portion of which may be considered as analogous to the cerebral ganglion of the articulata and gasteropodous Mollusca, which itself represents the optic lobes of the inferior vertebrata, the tub-quadrigenina of the Mammalia. Thus we observe that general, though not minute, analogies already exist in the order of development of the nervous system in man and the lower animals ; doubtless, if the subject were pursued with greater accuracy, many other interesting ones might be pointed out.”

It is with much pleasure that I refer the reader to the “principles of physiology,” as propounded by Dr. Carpenter, for confirmation of the views above set forth. At page 87 of his great work ‘On General and Comparative Physiology,’ Dr. Carpenter writes : “There is no department of anatomical or physiological inquiry in which more elucidation has been obtained from an extension of the survey to *all* forms of organized structure, than that which concerns the primary tissues. Botanists had long been aware that the cell (globe) is the type of vegetable structure ; that the simplest plants are composed of individual cells ; that those a little higher in the scale are made up of aggregations of cells not very different from each other in form and endowment ; that where other structures are present, cells still constitute the

essential part of the fabric, being the special instruments of its *vital* actions; and that these superadded structures are still closely related to the cellular, and are formed in the first instance by metamorphoses of the cells, of which the original embryonic structure and the tissue of all young plants are exclusively composed. It was known also that certain tissues of animals, especially the adipose and fatty, resemble those of plants in their simple cellular character; and as it had been established by observation of *their* embryonic structure, that even the most complex fabric takes its origin in a mass of cells, it was anticipated that a more complete analysis of the animal organism would show that many other parts of it are formed upon the same type." In the same author's account "of the primary tissues of animals" are these words, viz.: "In applying to the animal fabric those methods of investigation which have been attended with so much success in the analysis of vegetable structure, we at once perceive that the former is much more heterogeneous than the latter; that is to say, the number of dissimilar tissues is much greater, and the differences between them are far more decided; and this in proportion as we ascend the animal scale. In fact, there are many animal tissues, whose relation to the primitive *cellular* type is so obscure, that it can only be established by attentively watching the history of their development. This cannot be deemed surprising, when it is considered that the endowments peculiar to animals must necessarily be connected with organs or instrumental structures of a kind which the vegetable does not possess; and that the possession of these endowments involves numerous important modifications in the apparatus that ministers to the functions of vegetative life. Still we shall find the general rule to hold good, that all the animal tissues are developed in the first instance through the medium of cell-life" (globules); "and that in the organs subservient to the strictly

vital operations, cells remain the essential instrument. It is doubtful whether there are any beings unquestionably entitled to be regarded as animals, whose organization is so simple that they consist in their perfect state, like the humblest plants, each of a single isolated cell; whether thus temporarily ranking as a distinct individual, or occurring as a component of an aggregate fabric, is essentially the same as that of the vegetable cells into whose history we have examined, except as regards its dependence on external supplies for that pabulum which the latter can generate for themselves." And again, when treating on "the transformation of tissues," we read thus:—"Although the variety of tissues in the animal kingdom, and of the purposes to which they are subservient, is so very much greater than in the vegetable, yet we can trace them all back to the same origin, the simple cell; and we may observe somewhat of the same relation between the successive evolution of these tissues in the ascending series of animals, and their progressive development in the embryo of the highest that we have traced among plants; although the requirements of the several tribes of animals more frequently necessitate an apparent departure from this plan for some especial purpose. Many of the simpler forms of (so-called) animalcules must be probably regarded as nothing else than simple cells, which are endowed by their ciliary appendages with the power of free locomotion, but which contain no variety of organs, and multiply themselves (like other independent cells) by spontaneous fission. Now such beings cannot be properly compared to any of the higher animals, in the fully developed state of the latter; but they do present a very close correspondence to their earliest embryonic condition. For the life of the highest commences in a single cell, in which not the least vestige of its future organs or tissues can be traced; and this cell speedily multiplies itself by a process of binary

subdivision, until a homogeneous mass of cells is produced, bearing a very close resemblance to some of those composite clusters of animalcules which are produced in like manner, by the repeated bi-partition of a single individual. Ascending to those forms of animal existence in which distinct organs begin to show themselves, as in Zoophytes and Acalephæ, we still find the tissues composing the mass of the body almost homogeneous, consisting of a nearly structureless 'blastema,' with interspersed fibres and cells more or less completely developed; the cells, in some instances, the fibres in others, being the elements most fully formed. It is difficult to distinguish anything like muscular or nervous structure in such animals, nor do we meet with vessels having distinct walls for the conveyance of fluid; and the dense skeletons which many of them possess are formed upon the simplest possible plan. In the most important of these particulars, they correspond with the more advanced embryo of higher animals, in which 'morphological transformation,' or the evolution of distinct organs, proceeds to a considerable extent before 'histological transformation,' or the production of the more special forms of tissue, distinctly commences; a sort of mould or model of the organ being generally formed of cells before it presents any appearance of the structure which is ultimately to characterise it."

Now, if we will be at the trouble to inquire more particularly into these "cells" so constantly mentioned by Dr. Carpenter; if we will take the pains to investigate the nature of their vital properties, their specific offices in the animal economy, we shall, I think, conclude presently that the aforesaid *cells* are nothing more or less than the "nervous globules" (the seat or source of "nervous sensibility,"—Anderson), distributed in the homogeneous structures of the Polygastrica and Polypiphera, &c., and found to constitute the very sum and substance of the early embryo (human). What

says Dr. Carpenter then of the "cells," *alias* "nervous globules?" At page 87, we find his evidence in favour of the identity here mentioned thus expressed, viz.: "It seems to have been established, as the aggregate result of the labours of many observers, that in animals as in plants, all the parts in which active *vital* changes are taking place essentially consist of cells, which may be regarded *as the real instruments* of these operations." At page 103, there occur these words: "Still we shall find the general rule to hold good, that all the animal tissues are developed in the first instance through the medium of cell-life; and that in the organs subservient to the strictly *vital* operations, *cells* remain the essential *instruments*."

The inevitable conclusion from the facts and reasoning of Dr. Carpenter is, that the organic or vegetative functions, as observed in even plants, and in the lowest forms of animal life, are due to "the vital operations" consequent on their "cellular type of structure."

I cannot myself doubt that nervous matter *is* present in "a diffused form," *i. e.*, incorporated with the other tissues, in all those animals wherein no *distinct* nerve structures have been made out. I cannot dissociate the positive *vitality* of such animals from a highly elaborated (imperceptible?) nervous organism. There seems every reason to believe that the "cell-life" mentioned by Dr. Carpenter is, in all respects, identical with the "impetum faciens" of Hippocrates, the "materia vitæ" of Hunter, the "nisus formativus" of Blumenbach, the "irritability"¹ (*motions without force*) of Haller, the "creative force" of Muller, and so on.

¹ At page 190 of Dr. Carpenter's 'Principles of Physiology,' there is a note, from which we learn that whilst the doctor denies the probability of *nervous matter* being present in the lower order of animals in a *diffused form*, he nevertheless admits the existence of a *muscular power*, which "may be said to be *diffused*; for the entire substance of many of the lower animals seems to possess

I am aware that Dr. Carpenter would, in fact, does, refer each of these properties of matter, if I may so call them, to

some measure of that *contractility* which, in the higher, is the attribute of the muscular tissue only." The following remarks, from the pen of the late Dr. Fletcher, are so much to the purpose that I cannot forbear their introduction here. When treating "on the Muscular and Nervous Systems generally, regarded as the immediate seat of Irritability," we find these words, viz.: "Though neither of these systems (meaning the muscular and nervous systems) may be so far developed in plants and the lower tribes of animals as to deserve to be considered as distinct tissues, we are not, on that account, justified in denying that both may exist in them in a diffused and rudimental state; and that in this state they may be still competent to impart to the rest of the economy that property which the higher tribes of organized beings derive from their tissues only when concentrated and perfect. If, then, the arguments in favour of the doctrine that either of these systems is in the latter, the immediate seat of irritability appear to be well founded, we need have no hesitation in believing that it has a corresponding seat in the former; and should not certainly be deterred, as some have been, from regarding these arguments as tenable in their application to the higher tribes of organized beings, merely because the muscular and nervous systems are so little obvious in the lower that they seem to be quite wanting, any more than we are deterred from admitting that the lungs and heart, because so little concentrated in some tribes of being—which nevertheless respire and propel their fluids—as to appear to be absent are, in the higher races of animals, the chief instruments respectively of respiration and circulation."

It is argued by the same gifted author, that the ganglionic system of nerves is to be viewed as the "immediate seat of irritability, because the nerves of this system, while they are of a similar form, colour, and consistence when distributed on parts, the irritability of which is of the same character—that is to say, which are liable to be excited in the same manner by the same stimuli—being quite dissimilar in all these respects when they supply parts the irritability of which is different. Thus, whilst the filaments going from the ganglions to the several voluntary muscles, all which have one general character of irritability, are said all to display the same general aspect and physical properties, those which proceed from the cæliac ganglion, for example, respectively to the stomach, liver, and other organs, each of which has a character of irritability peculiar to itself, have these properties very distinct; those sent to the stomach being conical, white, and firm; those to the liver, cylindrical, red, and soft; and similar differences manifesting themselves between the filaments respectively of the splenic, mesenteric, hypogastric, and other plexuses. This remarkable coincidence, then, if generally admitted, of certain modifications of a common faculty, as displayed

“physical forces.” He teaches that “wheresoever no nervous tissue can be *detected* there, in that animal, the organic or vegetative functions, *i. e.*, “the active vital changes,” are the result of certain physical forces acting on “organized structure”—acting on, in point of fact, the “cell-germ.”

The annexed extract conveys the opinion of this eminent writer on a highly interesting question of physiological science: “We only know of *vitality*, the peculiar state or endowment of the being which exhibits that activity, as consequent upon that new arrangement of the molecules of matter entering into its composition, which we term *organization*. The conditions of that endowment, therefore, must be found in the properties of the original elements of the structure composing it, and in the forces by which they are brought into play. When we ‘magnetise’ a piece of steel by the agency of another piece already magnetic, or by the transmission of an electric current across it, we are but calling forth the properties which were previously dormant or inactive in the metal. So when the *cell-germ*, under the influence of light and heat, effects the combination of the inorganic elements into new and peculiar compounds, and applies these to the formation of its own structure, it does nothing else than call forth the dormant properties of those forms of matter.¹ For the existence of the properties which

by different organs, and corresponding modifications of a common system of nerves, as distributed to these different organs, seems to be a strong testimony in favour of the doctrine that this general system of nerves ministers directly to the general faculty in question.”

¹ What Dr. Carpenter calls the “physical forces,” or “dynamic conditions of life,” Dr. Fletcher has termed “the direct stimuli to irritability.” The first-named has these words (p. 44)—“No organized fabric, however perfect in its structure and composition, and however amply supplied with the materials requisite for its growth and maintenance, can perform a single vital action without the concurrence of certain other agencies, of the class commonly termed physical forces. These afford the *stimulus* or provocative to activity; and the germ

thus enable certain elements to become component parts of organized structures, and to perform vital actions, we can

could no more develop itself into a cell without the operation of one (at least) of them, than it could do so with their assistance, but without the supply of the alimentary materials. Hence these agents, light, heat, and electricity, when viewed with reference to their participation in the phenomena of life, have been termed "vital stimuli." Their operation on organized structures is not altogether without analogy to the influence they possess over inorganic matter which is exerted in the production of chemical phenomena. Thus the union between the two substances, which previously showed no tendency to combine, although in close contact with each other, may be frequently caused to take place, with various manifestations of energy, by the rudimentary influence of one of these agents. When chlorine and hydrogen are mingled together in a bottle, and this is placed in darkness, they may be left for any length of time without change. But the agency of *light* brings their previously dormant affinities into a state of activity; for if they be subjected to the direct rays of the sun, an instantaneous explosion takes place, with production of hydrochloric acid; whilst if exposed for some time to diffused daylight, they unite more slowly. The same effect may be produced by *heat*; for a union of the two gases occurs, with a violent explosion, when any incandescent substance is introduced into the mixture. And a like result is produced by *electricity*; the transmission of a spark through the mixture producing an explosion, with a generation of hydrochloric acid. In neither of these cases can we consider that heat was excluded; for although a high temperature was required to bring about the union when no other agent was in operation, yet neither light nor electricity could have effected the union, unless the elements had been in the gaseous condition which they present at all ordinary temperatures, in virtue of the latent heat they contain." Dr. Fletcher has conveyed the same theory or principle, in the following few lines, viz.: "Of the direct or primary stimuli to irritability, the chief are certain universally diffused agents, to which organized beings, in common with inorganic matter, are more or less constantly exposed; such as *caloric*, *light*, and *electricity*; others, of which they continually appropriate a portion to themselves, such as the medium by which they are directly surrounded, whether *air* or *water*, and the solid and liquid substances which they use as *aliment*; and others, lastly, which constitute at all times a substantial part of themselves, such as their various *fluids*, whether crude, mature, or secreted. Of the indirect or secondary stimuli, the principal are *sympathy*, and *passion*, or *instinct*—the two latter of which appear to be merely varieties of the former—and *volition*. In addition to these which may be regarded as more or less constant and salutary stimuli to irritability, and which, when neither excessive nor defective, consti-

assign no other cause than the will of the Creator. They are ultimate facts in physiology, just as attractions and repulsions constitute the ultimate facts in physics, and as do affinities in chemistry. The constancy of the actions which result from them, when the conditions are the same—that is, their conformity to a fixed plan, or (in the language commonly employed) their subordination to *laws*,—indicates the constancy and unchangeableness of the Divine Will; as well as the infinity of that wisdom by which the plan was at first arranged with such perfection as to require no departure from it in order to produce the most complete harmony in its results.” I must add, that if we will regard the “cell-germ” (Carpenter) as a “nervous globule” (Anderson), the above reasoning becomes very materially simplified *and* strengthened.

Dr. Carpenter looks on all those actions in the *hydra* and *actiniæ*, which are concerned in the prehension and digestion of food, as “really analogous to the peristaltic movements of the œsophageal muscles and stomach of higher animals, than to the motions of their limbs.” Granting the *analogy*, must it not follow, *if* the “peristaltic movements,” *i. e.*, the organic or vegetative functions of the quadruped or man, be the result of the normal action of a “cyclo-ganglionic” nervous system—as they really are,—that “the prehension and ingestion of food” in the animals named, must be equally the result of a nervous power precisely similar; and if so, what is the source or origin of such power, if it be not the “cell-germs,” *alias* “nervous globules” above referred to?

tute what may be called the *existing causes of health*, certain others occasionally come into operation, the action of which, as well as that of any of the preceding, when either in excess or deficiency, is prejudicial, and it is of these that the exciting causes *disease* consist; but with them we have nothing to do at present.”

I cannot see why Dr. Carpenter should take the objection he does to the theory which recognises the incorporation of the nervous matter with the other tissues of the lowest classes of animals—those of the “protozoa” for example. If, as Dr. Carpenter maintains, the tissues which go to form the bulk of the *hydra* and *actiniæ* just mentioned, are made up of “cell-germs,” the specific vitality of which is sufficient for the realisation of the several phenomena of organic or vegetative life, as manifested by those animals, then must I understand such a concession as really tantamount to saying that the nervous matter in such animals *is* present in a diffused form, *and* incorporated with their other tissues.

I feel a deep regret when engaged in the study of the writings of Dr. Carpenter to perceive, not only that he is so inclined to discredit the existence of a nervous system in the lower classes of animals, fearing, as it would appear to me, that its demonstration would endanger his *cell-theory*; but that he so frequently makes the “evolution of a nervous system” or otherwise, *i. e.*, “its apparent absence,” as the criterion of the possession or want of the *psychical property of consciousness in the lower animals*.¹

¹ Where there is *consciousness*, there must be of course nervous (cerebral) matter; but it by no means follows that where consciousness is *not* there can be no nerve-structure. The “cell-germs” of Dr. Carpenter are described by him as of different kinds, and as exercising a modified vital influence; and precisely the same may be said of the several parts of the nervous organism, *viz.*, the cerebral, spinal, and ganglionic. The “endowments,” he writes, of the cell in its perfect state, “are *extremely various*, . . . and their diversities constitute, in fact, the differences between the properties of the several tissues. Thus we find certain cells whose agency is exerted in developing a preliminary organization or vitalization in the liquid *pabulum*; which, when thus prepared, is to be yielded up for appropriation by other cells in process of development. This process we have designated by the term *assimilation*. Again, there are other cells which are distinguished for their power of *reproduction*; their function as individuals being apparently confined to the preparation of the germs of a new generation. Others, again, are characterised by the change of form which they

It is concluded then—

a. The ganglionic nervous system first exists in a molecular form; and that it is made up of globules dispersed throughout the homogeneous texture of the animal, as in the acriti, the lower Entozoa, &c.; as such it has also been presumed to exist in the early human embryo.

b. These nervous globules, arranging themselves in a longitudinal series, form filaments, and these “filaments” at length form a central point, a ganglion (*solar ganglion*, Anderson).

c. Ascending the scale of animal creation, and arriving at the *Mollusca*, nervous matter is found secreted about and around the œsophagus, and on the dorsal aspect of the animal (supra-œsophageal ganglion²); this nervous matter becomes, in the higher animals and in man, the tubercula quadrigemina or medullary oblongata.

d. Still ascending, the cyclo-ganglionic nervous system becomes more complicated, whilst the several tissues and

undergo, after having attained their development as cells; this change of form, rendering them subservient to some new purposes in the economy, originates entirely in their own vital activity, and must be considered as indicating a power of *morphological transformation*. In many other instances, the endowments of the cells are manifested in their power of effecting *chemical transformations*, of a kind which we do not meet with under any other circumstances. And both in animals and plants, but in the former more especially, we find a number of cells endowed with the power of giving rise to *mechanical motion*; either by sudden and temporary change of form, as in the contraction of a muscle, and in most of the sensible movements of plants, or by the vibratile action of certain filaments attached to the exterior of the cells, and termed cilia. Other cells in the animal body have it as their especial endowment to generate that peculiar power which we call *nervous agency*; the operation of which is more nearly allied to that of electricity than to that of any other power with which we are acquainted, though not identical with it.”

¹ This ganglion is, I think, the earliest indication of a *cerebro-spinal system* in animals; it would seem to be the *analogue*, not less of the spinal cord than of the brain itself, judging from the direction and final distribution of its *filaments*.

structures subordinate to the same, including the cerebro-spinal system, are proportionately amplified; the increased development of the former, and the general augmentation and addition of parts in the latter, being in the relation to each other as *cause* and *effect*.

CHAPTER II.

ON THE FUNCTIONS OF THE GANGLIONIC NERVOUS SYSTEM.

THE investigation of the physiology of the nervous system, says Dr. Cooke, in his work on nervous diseases, seems to have been at all times a favorite study. The wish to draw aside the veil from nature, to display the very essence of the vital properties, and to penetrate to their first causes, has ostensibly characterised the labours of many of the greatest men of both ancient and modern times (Lawrence's 'Lectures,' p. 166). We have some notices of it in the works of very ancient writers; thus Hippocrates, Plato, Aristotle, and others have speculated upon this subject, though in obscure and confused language. By these early writers, the brain, the heart, and the blood were each successively claimed as the seat of life and sensation. But inasmuch as the philosophy of the ancients, especially Platonism, soared above, or, to write more correctly, *below* the level of nature (Serres, on the 'Laws of the Development of Organs, or Transcendental Anatomy applied to Physiology'), it became reserved for subsequent investigators to afford any real and satisfactory explanation of the vital phenomena, and their relations to the organism. Aristotle, in his 'History of Animals,' was the first, I believe, to give any degree of attention to the study of those organic forms so necessary to be understood as the groundwork of all physiological knowledge. To

Aristotle succeeded Galen, whose work 'De usu partium' must be, at the present day, considered as highly interesting and instructive.

In reference to the labours of Aristotle and Galen, Serres observes—"The method of Aristotle, essentially descriptive, neglected the function for the form; that of Galen, essentially rational, neglected the form for the function. The first of these methods carried in its train the descriptive sciences; the second led to the general sciences: the truth thus lay in their combination—and to Haller we owe the merit of having first discovered this fact. He founded his arguments and opinions upon form and function combined; thus embracing in his method the descriptive as well as the general sciences."

Among the more modern medical philosophers, the name of Harvey stands second to none other, though, doubtless, he erred not a little in teaching that the *blood* alone possessed vital properties:¹ herein, however, he did but echo the opinions adopted and taught by many of his predecessors and contemporaries—and especially by Glisson and Albinus.

It is within a comparatively short period that the nervous system in man and animals was regarded else than *en masse*, and altogether indivisible. It would appear that Bichat was among the very first to perceive and to teach that the vital phenomena which living beings present to our observation are of two kinds: the one comprehends all those functions which tend to the maintenance and preservation of their individual existence, and the reproduction of their species;

¹ I quite agree with Dr. Elliotson, that Moses is no authority on this subject; and with him, I feel surprised that Harvey should have quoted Moses. The passages, "for the life of the flesh is in the blood"—"for it is the life of all flesh"—"the blood of it is *for* the life thereof," only mean that, when it is withdrawn, life ceases; that it is necessary to the life of animals. "The construction which would make Moses assert that the blood is alive, involves the absurd assertion that the blood only is alive." (Elliotson.)

while the other class of phenomena brings them into relation with the external world, informs them of the existence of surrounding objects, and, manifested in the activity of the intellectual faculties, teaches man in particular the properties of bodies and the laws which regulate them. Those functions by which the nutrition and growth of individuals and the reproduction of species are effected, are common to all living beings, vegetables as well as animals, and there can be no life without them; but the second order of functions, the manifestation of which proves to us that the individual is capable of receiving impressions from external nature, and of reacting upon these impressions, showing thereby a consciousness of their existence, is peculiar to animals (see Solly on the 'Brain,' p. 34). The foregoing physiological facts being conceded, the hypothesis of Galen, that the said "vital phenomena" were superintended or controlled in their operation by presiding spirits, became substituted by a more material and rational doctrine. Bichat was plainly enough dissatisfied with the assumed agency of "mysterious spirits," and looked to the nervous organism itself as the source or cause of the *first* as well as "the second order of functions" mentioned; and so it was that this acute and original thinker was led to divide "the nervous material into two systems," one of which he called the nervous system of organic or vegetative life, and the other of animal life. Bichat has, there appears little doubt, the credit of originating the doctrine of the entirety and independence of the ganglionic nervous system; but since his day very similar views have been taught by Richerand, Gall, Wutzer, Broussais, and Brachet (according to Mr. Solly), and lastly by the late Dr. Fletcher, of Edinburgh; but in spite of the labours of the several individuals named, we look in vain among the writings of Wagner, of Muller, of Mayo, of Carpenter, and of Todd and Bowman, for any precise information relative to the

offices of the ganglionic nerve-structure. The last named (Todd and Bowman) treat of it as more nearly allied to a cerebro-spinal nerve than to anything else. It would seem that the name of the illustrious Bichat stands in much the same relation to the ganglionic nervous system, as that of Gall¹ does to the brain—of which neither its anatomy nor physiology, or in other words its structure and functions, were much known before his time, or until he entered on their investigation, and gave to the world the results of his original labours. It may be added, that to Walker, who takes precedence of Bell in pretty nearly all that relates to the physiology of the spinal cord, we are indebted for the earliest information of the true spinal functions, *i. e.*, in so far as these are identified with the sensory and motory phenomena, and their location in the anterior and posterior roots (columns) respectively. Bichat, Gall, and Walker have been succeeded by men both able and zealous in the good cause of medical science; and to prove this much it is alone necessary to mention the names of such men as Blumenbach, Wilson Philip, Copland and Fletcher—as Spurzheim, Combe, and Elliotson—as Bell, Le Gallois, Blane, Mayo, Hall, and

¹ Nothing can be more interesting than to trace the progress of truth from the days of Bacon, Hobbes, Locke, and Coudillac, all of whom advocated the dependency of the mental (cerebral) impressions on the use of the external senses, in opposition to the doctrine of innate ideas, to those of Mirabeau, Priestly, Magendie, Lawrence, and others, of what is called the modern school of materialism, on to that era when Gall's discoveries illuminated this dull atmosphere of ours. The first class of writers named may be said to hold a similar relation to the second as the latter does to Gall and his school. The writings of Gall and Spurzheim cannot be too highly commended, not only because they realise a practical and truthful *psychology*, but because they demonstrate in the most conclusive manner the absurdities and chimeras of the metaphysical school. It may be truly said, that Gall has given the death-blow to the visionary speculations of such men as Descartes, Leibnitz, Malebranche, Reid, Stewart Mills, *et hoc genus omne*; and that on his successors rest the responsibility of rescuing alike the criminal from perdition, and the legislator from shame.

others. It is hardly necessary at this time to insist on the triplicate nature of this nervous organism, in man and the higher orders of animals. When Bichat wrote his very able treatise on 'Life and Death,' it was a source of complaint "that hitherto anatomists have considered the nervous system as an uniform system ;" but at this time, it is no uncommon thing to hear a medical brother discourse as if "the different branches of this system ought to be viewed as constituting *two*" and not *three* "general systems, essentially distinct; the one having for its principal centre the brain and its dependencies" (meaning, no doubt, the spinal cord) "and the other, the ganglions" (Bichat). However, every excuse is due to Bichat; but one can hardly find the same apologies for men of the present day; unless, like Le Gallois, they may have taken a fancy for regarding the spinal cord as the seat of all vitality, *i.e.*, "irritability"—as in this case the organic nervous system may be put on one side, and altogether forgotten; and its very existence denied.

In taking a rapid survey of the progress of "Neurology," one cannot but be struck with the zeal and ability manifested in the labours of Le Gallois; and what is more, one can hardly fail to draw a parallel between the nature and objects of this writer's researches, and those of Dr. Marshall Hall; however dissimilar in name, and on a superficial investigation, such may and do appear to us. Both Le Gallois and M. Hall declare the spinal cord to be the seat of a peculiar function; they affirm that that function is exercised in a manner wholly independent of the brain, and that each part of the body derives its principle of vitality and irritability from that portion of the spinal marrow from which it receives its nerves. The experiments cited by each of these writers have one common character, and a strict uniformity of purpose; they are intended to demonstrate the fact so long since taught and insisted on by Gall, *viz.*, that the cerebrum and cord are

in point of fact distinct organs, and that each one of them exercises an appropriate function, and is endowed with a specific vitality. At page 201 of Elliotson's 'Translation of Blumenbach's Physiology,' we read that Gall was the first to describe the spinal cord as an organ distinct from the brain, and *not* as a cord of cerebral nerves, and *not* as "the sole origin of the nervous power"—as was so long taught in the schools.

M. Le Gallois writes thus—"If in a rabbit which has been decapitated, but kept alive by pulmonary insufflation, the whole of the spinal marrow be destroyed by a stylet thrust through the whole vertebral canal, life will instantly and irrecoverably disappear, irritability alone remaining; which, we know, remains for some time after death. If, instead of decapitation, an opening be made in the vertebral canal, near to the occiput, and, by an instrument introduced through this opening, the whole of the spinal marrow be destroyed, although the brain, and its nervous communications with the trunk, remain perfectly untouched, life will be instantly and irrecoverably destroyed in the trunk, the head alone remaining alive, as is apparent from its gapings:" and Dr. Marshall Hall introduces his experiments to our attention with the following remarks, viz.,—"Until very recently, we viewed the contents of the spinal canal as a cord of cerebral nerves, and the origin of a part of the ganglionic system. Now, Gentlemen, it is very possible to remove the cerebrum, the centre of the cerebral nerves, and the ganglionic system, and yet leave another kind of nervous influence remaining in the animal body. I shall take this early opportunity of showing you a simple experiment. You see here an animal (a frog) from which the head has been separated, and of course I need not tell you that with the head the brain has been entirely removed; all the viscera have also been removed, and with the viscera *every portion* of the ganglionic system.

Now I beg here to repeat, the cerebrum, the centre of the spinal cord of nerves, and all the ganglionic, have been removed from this animal, and yet, when I pinch the extremity, it moves so as to be obviously perceptible at the remotest part of this theatre. Thus, as I said before, we have here removed the centre of the cerebral system, and the entire ganglionic system. The brain, which we know to be the centre of all the sentient and voluntary nerves, has been removed, the ganglionic system has been removed, and yet you observe something remains. Now, gentlemen, that which remains I venture to call—in contradistinction from what has been termed a cord of cerebral nerves, and the origin of the ganglionic system—the true spinal marrow. It is plain, in the first place, that it is not a mere cord of nerves; if it were a mere cord of nerves, you might divide it, and then you would intercept its influence. But, if you observe here, this influence passes not only from one extremity to the other, but it also passes from one set of extremities to the other set of extremities; thus it is quite plain that there is a nucleus of nervous matter between the two anterior extremities, and another nucleus between the two posterior extremities, by which these nervous links are united, and associated in their motions one with another. Having thus then clearly laid before you the distinction which I wish to insist upon, namely, that there is not a division of the nervous system into two parts only, but into three, pervading all the different parts of the whole animal frame, I shall venture to term them the cerebral, the true spinal, and the ganglionic systems.”

It is seen that, according to Le Gallois, with the destruction of the spinal cord, the *life* of the animal instantly and irrecoverably disappears; and that, according to Dr. Marshall Hall, with the preservation of the spinal cord the life of the animal is maintained, although both the brain and ganglionic

system be removed. The inference appears to be, that the said cord must be regarded as the *bonâ fide* seat of vitality, *i. e.*, irritability. Now the "irritability" which Le Gallois tells us "remained" after the extinction of "life" in the rabbit, the spinal cord of which he "destroyed," was doubtless due to the integrity of the ganglionic nervous system. This had been left intact, and was therefore in a position more or less, and in spite of the shock sustained by the system generally, to continue its specific functions; and hence the "irritability" of which the experimenter has spoken. The annihilation of the spinal marrow of necessity limited the external indications of the same *irritability*, and removed them from the peripheral extremities of the nerves themselves, the roots of which were necessarily powerless (paralysed). The rabbit was reduced to a mere vegetative existence, and realised in its altered state a condition of being like that which belongs to the common *medusa* (for example's sake), or more properly, perhaps, to the singular monstrosity recorded by Dr. Marshall Hall himself, in which there existed neither a brain nor a spinal cord: but, in this example of abnormal development, as in others of the same kind, the "*irritability*" here mentioned was plainly remarked, and has been commented on. In a word, the possession of "*irritability*" by the decapitated and marrowless animal must assure us that the solar ganglion and its accessories were in the exercise of their specific functions in all that portion of the animal organism not involved in injury and disintegration.

Le Gallois has, in my judgment, considered the cessation of the mere spinal or excito-motory functions in the mutilated rabbit as an indication of the complete suspension of all the vital phenomena: and hence the fallacy of his physiological conclusions above mentioned.

From the tone of Dr. M. Hall's remarks herein cited, it

would seem that the Doctor is himself the discoverer of the facts insisted on. With all deference I would submit that long before Dr. M. Hall wrote on the nervous system, Gall and Spurzheim had proved that the spinal cord was *not* “a cord of cerebral nerves,” but that it had a specific and independent office of its own, altogether alien to the brain, and therefore independent of either *consciousness* or *volition*. It was Le Gallois who taught that *the spinal cord was the origin of a part of the ganglionic system*; but I am not aware that “we viewed” (by which I understand the medical profession “viewed”) this opinion of our continental brother as one entitled to our confidence. May I not add that *we* never accepted it—that it has never yet been taught in the schools, or recognised as an anatomical *fact*. Now if the experiment on the frog, as above detailed in the words of Dr. M. Hall, was of the value claimed for it, there would have occurred, on the extremities being pinched, not the mere *movement* “so obviously perceptible” to M. Hall, but nothing more or less than the excito-motory phenomena; in their stead, however, there were present only “*the motions without force*”—that peculiar “irritability” (Haller) which belongs to the organic nervous structure. This, it is well known, is everywhere diffused through the organism; and its very presence is indicated by the “irritability” aforesaid—a truism this which obtains throughout the lengthened chain of being, from one extremity to the other, from *man* to the *medusa*. The “irritability” observed by Le Gallois, in his experiment with the headless rabbit, and that manifested by the frog in the hands of Dr. M. Hall, was precisely of the same kind, though plainly much modified by the circumstances of the vivisection in either case. It may be allowed me to deny one assertion made by Dr. M. Hall: it is that wherein he assumes (nay more, affirms) that the removal of the whole of the viscera of the frog necessitated that of “every portion of the

ganglionic system"—"the entire ganglionic system." I feel confident that Dr. M. Hall will, on a reconsideration of this matter, directly perceive that such a proceeding is altogether impossible—so intimately and indissolubly connected and incorporated as the ganglionic system is with each fraction of one and all of the animal tissues.

It must never be forgotten that each ganglion belonging to the organic nervous system is held to be independent of every other; and, what is more, each nerve proceeding from a single ganglion is, in a great measure, (writes Mr. Solly, on the authority of no less an individual than Cuvier himself) independent of that ganglion, "and even that each point of such nerve is independent of all the rest; and constitutes, *per se*, a distinct focus of nervous influence." Richerand and Gall adopted similar tenets; and these are further inculcated by Wutzer and Broussais; the latter, in particular, describing the ganglionic system of nerves as possessing a peculiar kind of sensibility (*i. e.*, irritability) with which it immediately endows all the organs destined for nutrition, secretion, and the other organic functions; and, by means of its repeated connections with the cerebro-spinal system, all organs and parts of the body. It is, moreover, well known that Proschaska and John Hunter taught that the nervous power is generated throughout the whole extent of the nervous system, even to the smallest nerves; and that it can exist, for a *certain time*, in the nerves (ganglionic) of any part, independently of its source; and there can be no doubt of it. The heart of the shark will contract vigorously for even many minutes after its removal from the animal—a fact which in itself proves, in the words of Hunter, that the nerves of a part *will* continue the same action which they receive.

In connexion with this division of my subject I may very appropriately call the attention of my reader to the experi-

ments long since instituted by that accomplished physiologist, Sir B. Brodie. Their object was to disprove the assertions and opinions of Le Gallois already mentioned, to the effect "that every part of the body derives its principle of vitality and irritability from that portion of the spinal marrow from which it receives its nerves."

Experiment 1. Sir B. Brodie divided, in a dog, the skin and muscles which lie before the axillary plexus of nerves, and afterwards the nerves themselves. He then divided the remaining skin and muscles, the cellular membrane, and every other part connecting the anterior extremity to the trunk, with the exception of the axillary artery and veins; *so that the vessels were completely insulated*, and formed the only connexion between the limb and the trunk. The divided edges of the skin were united by sutures. Twenty hours afterwards, an incision having been made in the forearm, the arteries bled freely, and the blood was of a bright scarlet colour. The muscles, by means of the voltaic battery, were readily made to contract, and when several pairs of plates were employed, the contractions of the muscles did not appear to be less powerful than those which arise from the stimulus of the will.

Experiment 2. Sir B. Brodie removed the whole of the posterior part of the spinal marrow of the frog. The wound healed readily; but the hind legs became, of course, paralysed. Five *months* afterwards, the muscles of the hind legs were found still capable of powerful contractions, under the influence of the voltaic battery; at the end of six months more, the muscles still retained their contractile power. The frog was then killed. The wound was found completely cicatrized; there was not the smallest appearance of regeneration of that portion of the spinal marrow which had been destroyed.

With regard to the former experiment, it will be observed that the complete insulation of the axillary vessels rendered

the further transmission of nervous influence impracticable, else than just so much as could find its way into the upper extremity through or along the trifling amount of nervous structure (globules) entering into the formation of the delicate coats of the artery and vein constituting the only bond of union between the fore-leg and the body of the dog; but in connexion with this fact it will be remembered that, upon the principle already explained, the imperfectly dissevered limb of the dog, being in possession of an abundance of nerve-matter (ganglionic), it was rendered to some extent independent of the ganglion of the trunk of the body. Sensation and motion (spinal) in their ordinary acceptation were necessarily discontinued on the performance of the vivisection, but a certain yet limited amount of "nervous power" (ganglionic) was nevertheless generated; and hence was it that "the muscles were made to contract," and scarcely in a less powerful degree than could be expected from the stimulus of the will. A comparison of the two experiments recorded by Sir B. Brodie will show that the fore leg of the dog and the hind legs of the frog were in all respects alike—that is to say—their acquired anatomical conditions were on a par; and hence was it that in both instances the "contractile power," the "peculiar kind of sensibility"—*i. e.* "IRRITABILITY;" or, if Dr. M. Hall will prefer to have it so—the *something which remained*—was, on the application of a stimulus, so distinctly manifested in either case.

The reader will, doubtless, directly perceive that the experiments of Le Gallois, Hall, and Brodie, are just so many practical demonstrations of the persistence of that peculiar "irritability" in the mutilated animal, which all fair experience and reason go to prove is a specific function, or power, or quality exercised ("generated") or possessed by the ganglia of the great sympathetic nerve, even to its minutest ramifications; and that the integrity of the spinal column in

the frog operated on by Dr. M. Hall may, in itself, and for obvious reasons, have rendered the external signs or indications of such vitality or "*irritability*" more evident than under other circumstances; and, moreover, that these same *signs* or *indications* may have assumed a specific character, harmonizing, more or less, with the excito-motory phenomena. There seems yet reason to believe, that in the case of an eviscerated and headless frog, the gray matter of the cord itself may *retain* for a limited period, if it may not *generate*, a nervous influence (though derivable originally from the ganglionic nerve-matter) which shall evoke a "*something*" (Hall) bearing a faint and very temporary similitude to the true spinal functions.

Sir B. Brodie has without a doubt furnished the profession with data sufficient not only to negative the conclusions of Le Gallois, but indirectly to explain the real nature of those "motions" elicited by pinching the extremities of the frog in the experiment quoted above, from the Lectures of Dr. M. Hall.

Under these circumstances, then, we come to understand why, on the annihilation or removal of the "cerebrum" and "viscera," and a large portion of the ganglionic system, that within the abdomen, and amalgamated with the said "viscera" a "something remains" (Hall), call it by what name we may—either "a nervous influence"—"true spinal motor power" or "a peculiar kind of sensibility, *i. e.*, irritability."

I have on many occasions performed the experiment on the frog, as detailed by Dr. M. Hall, and I have invariably found that the removal of the viscera and ganglionic system, as described by him, is fatal to the life of the animal; and that what Dr. M. Hall has called the "true spinal phenomena" (irritability) as manifested by the eviscerated and headless being, are continued no longer than *that peculiar kind of sensibility* (contractility) which may be at any time observed in the heart or

intestinal canal, and so on, of any animal, after the removal of either from the trunk. That the vitality of the spinal cord—and not less its capacity to execute its normal functions in the animal economy—is derived from the ganglionic nervous system is to my mind certain; and not less easy of demonstration than is the presence of the sun at noonday.

One word more, ere I conclude my criticisms on the experiments of Drs. Le Gallois and Hall. The latter gentleman finishes the description of his famous experiment on the frog with these few words, viz.—“Having thus then clearly laid before you the distinction which I wish to insist upon—namely, that there is not a division of the nervous system into two parts only, but into three, pervading all the different parts of the whole animal frame—I shall venture to term them the cerebral, the true spinal, and the ganglionic systems.” I would remark that, whilst accepting this division of the nervous organism, I would submit that both the first and the second named are dependent on the third; that they derive not only their very existence and integrity from it, but also perform their respective functions in virtue only of the influence they receive from it; and that they are, as it were, employed by it to establish our dependency on, and relationship to, the external world, of which man forms a part.

The cerebral and spinal systems of nerves together perform the *animal functions*, which, in the words of an eminent physiologist (Blumenbach), prove us feeling, thinking, and willing beings; they are the actions of the senses, which receive impressions; of the brain which perceives them, reflects upon them, and wills; of the voluntary muscles, which execute the will in regard to motion; and of the nerves, which are the agents of transmission; the brain is their central organ. The ganglionic system of nerves, with the solar ganglion for its central organ, performs the vital or organic functions—

these are altogether independent of mind, and give us simply the notion of *life*. Secretion, nutrition, exhalation, absorption, and calorification, &c., being under its immediate influence and control throughout the whole body, it must preside equally over the *brain* as the stomach, equally over the *spinal cord* as the liver or uterus. In point of fact, if either one of these organs or viscera just named were removed from the influence of the ganglionic nerves entering so largely into its very composition, its specific vitality must cease, *i.e.* the function it was wont to exercise would end in the individual—its contribution to the sum total of *life* would be withheld.

Müller, it is well known, has written much about an “organizing principle,” a “creative force.” Admitting, for argument sake, the existence of such a quality, it would seem to be *first* directed towards the development of a central organ or organs (the solar ganglion or the ganglia of the sympathetic) predestined not only to give *life* but *form* to the whole animal organism—and which, moreover, it creates; predestined to give to the “organic creative powers,” as they are termed, their peculiar force and direction; which together determine the essential parts of the future animal, and its rank and position in the scale of infinite being; assign to the same its genus, or species, or variety—and give it, in short, “a local habitation and a name”

“Human, angel, man—

Beast, bird, fish, or insect—what no eye can see,

No glass can reach, from infinite to thee;

From thee to nothing.”—POPE.

Predestined, lastly, to hold a precisely similar relation to the otherwise insensible and inert frame—to the otherwise dull and unmoving organism, as the “vital fire” to the animated statue of *Prometheus*.

In enumerating the opinions of physiologists, I must not omit to mention those of Hunter and Lawrence. As may have been expected of those eminent and learned surgeons, the question of the nature of *life* was too important and interesting to be passed silently by. Hunter's opinions may be best expressed in the words of Abernethy, contained in a letter to Dr. Cooke, and published in his 'Nature and Uses of the Nervous System.' Abernethy writes thus, viz.: "Mr. Hunter's illustrations of his notions of life, by saying that it was suspended, as electricity and magnetism may be to substances in which they may inhere, was given in his lectures, and I have heard it from his own mouth. It made a strong impression upon my mind, because it did not affirm what electricity or magnetism or life were, but only stated an analogy." Both Hunter and Abernethy strongly insisted on the importance of not confounding life with organization, as many did. Mere composition of matter, observes Hunter, does not give *life*, for the dead body has all the composition it ever had; nor do organization and life depend in the least on each other. Organization, he adds, may arise out of living parts, and produce action, but life can never rise out of, or depend upon, organization. An organ is a peculiar conformation of matter, let that matter be what it may, to answer some purpose, the operation of which is mechanical; but mere organization can do nothing even in mechanics; it must still have something corresponding to a living principle—namely, some power. This *living principle* Hunter recognised by the term "*materia vitæ diffusa*," and which Mr. Lawrence ridicules as a mere fancy, an idle speculation, and of no better repute than the "*impetum faciens*" of Hippocrates, the "*archæus*" of Van Helmont, or the "*anima*" of Stahl. In commenting on these definitions of a living principle, Mr. Lawrence observes: "Most of them have long lain in cold abstraction amongst the rubbish of past ages; and the more

modern ones are hastening after their predecessors to the vault of all the Capulets." Mr. Lawrence's views of life I cannot think are more satisfactory than those of Hunter. At the same time that it is admitted that to call life a property of organization would be unmeaning, would be nonsense, he claims for the "primary or elementary animal substances" those vital properties which enable the compounded organs to carry on their several functions, which, he adds, being united in the individual, constitute *life*. Mr. Lawrence, therefore, literally makes life the property of the organism—just as gravity, elasticity, &c., are the physical properties of inorganic bodies.

Mr. Lawrence, it is seen, has herein adopted the explanation offered by the German physiologist Reil,—in reply to whom Müller says: "It would follow, that if the elementary composition were alone the cause of the organic forces, it would be at the same time the formative principle itself. Now, since in organized bodies, immediately after death, the elementary composition of the organic matter does not appear to be different to that of bodies still living, Reil must admit the existence of other more subtile elements, not recognisable by chemical analysis, which are present in the living body, but are wanting after death." Dr. Elliotson writes thus: "As the fluids which form the embryo must be endowed with life, organization cannot be the cause of life; but in truth organization is the effect of life, although, when produced, it becomes an instrument of life." The erroneousness of the French doctrine, that "life is the result of organization," has been ably refuted. The error appears to have arisen, in some measure, from the want of definition,—the word life being used, sometimes properly, for the power; sometimes improperly, for the result. Even if the result of life—the functions of a part—should be called its life, life could not be said to be the result of organization, but of a power to which

organization is an instrument. Now both the organization and its functions may be said to be demonstrable to the senses, but the same cannot be said of the "*power* to which organization is an instrument," though neither its presence nor its seat can well be doubted. Granting for the sake of argument, that the *ganglionic* nervous system, is the source or origin of this *power, or organizing principle, or creative force*,¹ which is exerted even on itself, and in every animal, in accordance strictly with what the nature of each requires, which exists already in the germ, and creates in it the essential parts of the future animal, and according to an eternal law, forms the different essential organs of the body, animates them, and modifies the already existing nervous system, as well as all the other organs in the laws of insects during their transformation, causing the disappearance of several of the ganglia of the nervous chord, and the coalescence of others; and by its operation, during the transformation of the tadpole to the frog, causes the spinal marrow to shorten in proportion as the tail becomes atrophied, and the nerves of the extremities formed, &c.,—granting, I say, so much, it remains to show, if possible, the *ultimate cause* of this important part of the organism—from whence did it receive its being? It is not in the power of *man* to offer anything more than a very general reply to these queries.

Mr. Lawrence observes, in his 'Lectures on Life'—"Having thus proceeded as far as we can in ascertaining the nature of life by the observation of its effects, we are naturally anxious to investigate its origin, to see how it is produced, and to inquire how it is communicated to the beings in which we find it. We endeavour, therefore, to observe living bodies in the moment of their formation, to watch the time when matter may be supposed to receive the stamp of life, and the inert

¹ It is said to have an existence independently of any special organ.

mass to be quickened. Hitherto, however, physiologists have not been able to catch nature in the fact. Living bodies have never been observed otherwise than completely formed, enjoying already that vital force, and producing those internal movements, the first cause of which we are desirous of knowing. However minute and feeble the parts of an embryo may be, when we are first capable of perceiving them, they then enjoy a real life and possess the germ of all the phenomena which that life may afterwards develop. These observations, extended to all the classes of living creatures, lead to this general fact, that there are none which have not heretofore formed part of others similar to themselves, from which they have been detached. All have participated in the existence of other living beings before they exercised the functions of life themselves. Thus we find that the motion proper to living bodies, or, in one word, life, has its origin in that of their parents. From these parents they have received the vital impulse; and hence it is evident, that, in the present state of things, life proceeds only from life, and there exists no other but that, which has been transmitted from one living body to another, by an uninterrupted succession.¹

¹ This opinion, so confidently asserted by Mr. Lawrence, is more than likely to undergo very considerable modification, in consequence of the publication of the 'Vestiges of the Natural History of Creation;' wherein it is to my mind satisfactorily shown that *life* does NOT even now only proceed from *life*. The experiments of Messrs. Crosse and Weekes are conclusive, and clearly negative the contrary assumption so much insisted on. The appearance of the 'Vestiges,' &c., must be viewed as a great and glorious era in the world's progress. It marks the onward course of truth and of religion, untainted with that mean and despicable credulity with which the ignorant delusions of the fanatic, of whatever denomination, associate and degrade it. The character of the reviews which I have seen of this excellent and truly philosophical book bespeak too plainly so great a preponderance of the low, the animal propensities, that, it may be rightly inferred, the time is yet far distant when the constant and unfailing supremacy of the moral sentiments and the intellect shall find *man* in unison with that

If organism or the organized state be the result of the union of the organic creative powers and organic matter, it would seem plausible to infer that the first is supplied by the male animal, whether oviparous or viviparous, and the second by the female. The peculiar circumstances which, it may be presumed, attend this union, and the consequent development of the vital properties, will probably remain a mystery. It would, however, appear, that the first effort of the vital properties, whatever they may be, are directed towards the development of a central organ, the solar ganglion, predestined to hold a precisely similar relation to the otherwise insensible and inert frame, to the dull and unmoving organism, as the vital fire to the animated statue of Prometheus.¹

In the very spirit expressed by Mr. Lawrence in the above quotation from his excellent and instructive lectures, did Ackermann commence and pursue his inquiries into the nature of which he is but a part, and so no longer deserve the censure of the poet, as conveyed in the few following lines :

“Hath nature’s soul,
That formed this world so beautiful, that spread
Earth’s lap with plenty, and life’s smallest cord
Strung to unchanging unison, that gave
The happy birds their dwelling in the grove,
That yielded to the wanderers of the deep
The lovely silence of the unfathomed main,
And filled the meanest worm that crawls in dust
With spirit, thought, and love ; on man alone,
Partial in causeless malice, wantonly
Heaped ruin, vice, and slavery ; his soul
Blasted with withering curses ; placed afar
The meteor happiness, that shuns his grasp,
But serving on the frightful gulph to glare,
Rent wide beneath his footsteps ?”

SHELLEY.

¹ See ‘Lectures on the Study and Practice of Medicine,’ p. 124, by John Conolly, M.D., late Professor of the Theory and Practice of Medicine at the London University, and Physician to the Middlesex County Lunatic Asylum, Hanwell, &c. &c.

development of the nervous organism in the embryo ; and with no preconceived views or opinions on this interesting subject, he concluded, nay more, insisted on it, that the organic or ganglionic nervous system is that particular portion of our organism which is first formed *in utero* ; and may therefore be rightly considered as the *germ* of all the phenomena to be afterwards developed. Müller writes, in his 'Physiology' translated by Dr. Baly that—"Ackermann asserts that the sympathetic nerve is the part first formed in the foetus," and from the same authority I learn that this opinion is entertained by Rolando, who has declared that—"what has been usually considered as the first traces of the vertebræ, at the sides of the spinal cord, in birds, to be the ganglia of the sympathetic nerve." Moreover, the assertions of Ackermann and Rolando are confirmed by both Blumenbach and Gall, the former of whom writes—"The nervous system" meaning the organic nervous system, "of the chest and abdomen are fully formed, while the brain appears still a pulpy mass ;" he adds—"these ganglia and nerves would hardly be formed before the brain and spiral marrow, but for the sake of the organs which they supply ; and the functions of which are as perfect at birth as at adult age, while the mind and brain are slowly perfected." It is impossible not to attach the very highest importance to the evidence here adduced in favour of the *priority* of the ganglionic system ; the fact is in itself plainly confirmatory of the physiological tenets this small book is intended to demonstrate. Nothing can appear more reasonable than that the portion of our organism, from which every other takes its character and vitality, should enjoy a prior existence. The foundation is constructed before the house—the base before its superstructure.

If we will be at the trouble to consult the pages of Blumenbach or Müller, for example, it will be seen that very much stress has been laid on what is called a *nisus formativus*,

and to this has been referred all that vital energy and power so indispensable to the creation, growth, and maturity, of the animal form; thus Blumenbach tells us that the *nisus formativus* "occurs to the genital matter, when this is mature and committed to the uterus in a proper condition and under proper circumstances; produces in it the rudiments of conception; gradually forms organs fitted for particular purposes; preserves this structure during life by nourishing the body; and reproduces, as far as it can, any part accidentally mutilated;" or, in other words, "it excites, even in its rudimentary existence, the elaborated fluids of successful coition; and vivifies and shapes the hitherto shapeless spermatic matter, partly into the beautiful containing ovum, and partly into the contained embryo;"¹ and Dr. Elliotson says that the "*nisus formativus* produces a being generally resembling the parent, but occasionally different."

Now with what is this "*nisus*"—this "energy truly vital" connected—in what does it originate—on what does it depend for its integrity and continuance—if not with, or in, or on, the ganglia of the sympathetic nerve? These, I conceive, in some marvellous way, exercise the *architectural power* which is employed in man and animals—from man downwards, through the whole of animated nature to the very lowest link in the chain of being. I cannot doubt that to their peculiar and vital influence must be conceded the wonderful and successive metamorphoses or changes which characterise, not only the intra and extra-uterine existence of the human form, but also that of animals, whether oviparous or viviparous; and under circumstances both of normal and *abnormal* action. It is readily seen that if from any cause the "organic affinities" (Müller) in progress in the foetus be interfered with—

¹ See Blumenbach's 'Physiology,' translated by Dr. Elliotson, p. 492, "Of the *Nisus Formativus*." The word "*nisus*" Blumenbach says, "he has adopted chiefly to express an energy truly vital."

if the balance which should obtain in the distribution of the imponderable matters in the organic tissues be disturbed, the action of the organism and of the separate organs may be so modified as to give rise to the formation of some one kind or other of *monstrosity*. An injury done to a seed during its germination is seldom unattended with ill effects : the radicle or the plumule will, the one or the other, suffer, and perhaps both. The injury done may be confined to one of these parts, and yet it may very seriously affect the vital principle in operation, and so modify or aggravate the original mischief. It is precisely so with the foetus ; any abnormal change in the component matter of any of its parts may prove irremediable, and the effects of which being then communicated to the solar ganglion, or to the central ganglia of the sympathetic nervous system, may excite so altered a vital action in it as to prove incompatible with the full and normal development of either itself or of those parts dependent on it ; and hence the existence of *monstrosities*—of acephalous and other malformed children : among whom the physical characters of the biped are more or less substituted by those of beings lower in the scale of creation. “Human monsters,” writes Blumenbach, “are not unfrequently met with who strongly resemble the form of brutes ;” and it is “because the *nisus formativus* having been disturbed and obstructed from some cause or the other, could not reach the highest pitch of the human form, but rested at a lower point, and produced a bestial shape.” He adds, strangely enough,—“On the contrary, I have never once found among brutes a true example of monstrosity which, by a bound of the *nisus formativus*, bore any analogy to the human figure.”¹

¹ Lord Monboddo, I think it is, who has considered that *man* once possessed a caudal appendage, or, in other words, a *tail* ; and, if so, there seems reason to believe, not only that Blumenbach has erred in supposing, which he evidently does, that the “*nisus formativus*” has never bounded forward, and so realised a

Of all the "human monsters" (Blumenbach) with which the records of medical science have made us acquainted, there are none more strange and interesting than such born without

higher and more advanced organism; but, what is more, that the very clever author of the 'Natural History of Creation' is quite right in regarding the genus homo as indebted to the monkey tribe for its origin and birth. To be serious,—there are facts in the history of man which, to my mind, satisfactorily demonstrate the capability of the "nisus formativus," under certain circumstances, to "bound" onward. In the instances of the negro Capetain, Rammohun Roy, Prackrama Bahoo of Ceylon; Carrera, of Central America, and Eustache, of St. Domingo, we recognise men, though born of parents belonging to an inferior order of being, as contrasted with the European, who, in the exercise of mental powers at once brilliant and profound, and in the full possession of energies, as untiring as they were generally well directed, sought not only their own advancement but their country's good; and who, actuated by a love of honest independence, and a spirit of honorable emulation, endeavoured, with more or less success, to emancipate the oppressed, and promote the permanent and best interests of the community. Some objection may, perhaps, be rightly taken to *Carrera*; however, no one acquainted with his career in Central America can deny him great talents and courage, and some virtue. Those of my readers acquainted with phrenology are, of course, aware, that, as it is with the inferior animals, viz., the horse, dog, &c., so it is with man; the several varieties of each genus, whether that of *man*, *horse*, or *dog*, are characterised by specific and well-marked differences in the bodily organization, which always correspond to the habits, inclinations, and general capacities, mental and corporeal, of such varieties individually. Now, the individuals above named were, one and all, descendants of the inferior races of mankind, as compared with the European; yet does the life of each one present us with facts of such a nature as plainly indicate the possession of talents and capabilities, and even virtues, which belong not to their progenitors, else than as an exception, but are characteristic, in an eminent degree, of the highest branch of the Caucasian family of the human species. Such being the case, is it not fair and logical to conclude, that the "nisus formativus" did, in the several instances here cited, "bound" onward, and so realise a higher type of being; a fact which, in my opinion, is plainly and satisfactorily demonstrated in the cerebral organization of the individuals named. The scientific world is in possession of the crania of the first, second, and fifth, and their organization is such as belongs to the higher or European (Caucasian) type or variety of man. Physiologists are, I think, too apt to suppose that all temporary changes in the parent terminate with his or her existence, and that they or their effects are not transmitted to the offspring. I cannot help thinking that we

either a brain or a spinal cord (*amyencephalous*). Dr. Marshall Hall has himself recorded a "remarkable case" of a foetus born "without either a brain or spinal marrow, with-

have only to wait the happy concurrence of the necessary circumstances to reach yet a far higher and more subtle nervous organism than philosophers generally have yet dreamed of. The birth of such men as Pascal, Ferguson, Lawrence, Oberlin, Lavater, Melancthon, and Gall, with some others, justify us in our anticipations. The operation of the same law of nature which preceded and attended the creation of either Rammohun Roy or Eustache, &c., is alone necessary, in the well-formed and beautifully organized European, to the existence of all that is really great and good in man. Such can be alone required to realise either the luxuriant fancy of the poet, or the highest and best hopes and aspirations of the heaven-born philanthropist. With reference to the certain circumstances above alluded to, I would remind the reader that the *physical well-being of man* is quite indispensable to his moral and intellectual advancement. The use of wholesome and sufficient food, the respiration of pure air, good clothing, frequent ablution, and a proper amount of muscular exercise, are, combined, no less necessary to the amelioration and advancement of the mental powers, and the higher sentiments and affections of our nature, than is *education*, strictly so called. The inevitable effect of a good *physical régime* is to improve the material organism of the brain and nervous system, and so impart a sound and healthy tone to their functional powers. To this end do the labours of Dr. Southwood Smith tend. The attention now being directed to the sanitary arrangements of our metropolis and great towns will, doubtless, furnish the means of promoting, in an eminent degree, the perfect civilization of mankind. If, as we are taught, the same physiological principles, modified, obtain in the vegetable as in the animal world, then are we bound to admit that the transmutation of a common marine plant into the cabbage, and, not less, the transmutation of oats into barley, and even into wheat, authorise us to anticipate the creation, at some future time, of a *second* species of the genus *Bimana*, "the highest type of animated being." (See 'Natural History of Creation,' p. 369, third edition.) "I have long held an opinion," says Sir M. Faraday, "almost amounting to conviction, in common I believe, with many other lovers of natural knowledge, that the various forms under which the forces of matter are made manifest have one common origin, or, in other words, are so directly related and mutually dependent, that they are convertible, as it were, and possess equivalents of power in their action." The history of the "Grimstone pea" is an evident and beautiful illustration of a "transition from species to species," (the consequence of the operation of a principle precisely analogous to that which obtains in the "laws of development" of the bee, and which, by a mere

out a particle of either of those organs yet perfectly developed." Blumenbach, too, has furnished the profession with a parallel experience: he writes thus—"In foetuses without brain or spinal marrow, the circulation, nutrition, secretion, &c., proceed *equally* as in others, which, besides spinal marrow, nerves, and a ganglionic nervous system, possess a brain." It is fair to conclude, from all we know of the anatomy of such monsters (amyencephalous), that such *are* brought into the world "perfectly developed," and duly *nourished*, because only the organic or ganglionic system of nerves is in them not only fully formed, but in the exercise of its appropriate and normal function. The records of embryology furnish us with many important facts bearing on physiology and pathology; but with none more so than those connected with the creation and birth of amyencephalous children: *i.e.* children—if one may so call them—without either a brain or spinal cord—without a vestige of a cerebro-spinal system. The fact, however, striking and remarkable as it is, is found in no way whatever to affect the creation, growth, and maturity of that portion of the animal organism which remains to them. The body, such as it is, is "perfectly developed," and therefore is it certain—a matter of direct demonstration—that all the strictly vital functions have been in full operation during intra-uterine life; and this independently of, and positively *without*, either a brain or spinal marrow. In the very interesting case of acephalous monstrosity published by Mr. Lawrence, in which the *brain* only was wanting, we learn that all the excito-motory functions were duly performed; it gave

modification of the embryotic progress, determines the sex, &c.)—This pea, the product of seed, immured for nearly 900 years, in an antique vase buried in a mummy-pit in Egypt, (and discovered by Sir G. Wilkinson,) and whereby its germination was so extraordinarily protracted,—furnishes, in itself, the strongest possible evidence in favour of the *opinion* of the great philosopher just named, and in contradistinction to the assertion of the German physiologist Blumenbach.

evidences of pain, and "at first moved very briskly," and the sphincters performed their office. Such, of course, was referrible to the integrity, generally, of the spinal cord. "The child's *breathing* and *temperatare* were natural; it discharged *urine* and *fæces*, and took food." The latter set of circumstances indicated the operation of the functions of the ganglionic nervous system, and without any aid from a brain. The ganglionic and spinal nervous systems were natural, and they exercised their respective functions accordingly.

The cases cited above, from the writings of Hall and Lawrence, afford in themselves the most conclusive evidence in favour of the independence of the organic or ganglionic nervous structure, *i.e.*, in so far as the cerebro-spinal system is concerned: they prove, beyond all doubt, not only the capability of the great sympathetic nerve to sustain the intra-uterine life of the brainless and marrowless foetus, but its power, alone and unaided, to develop and mature the organism itself. Who, in looking to the "amyencephalous"—to the brainless and marrowless monster described by Hall, could dare affirm that either the *brain* or the *spinal cord* were in themselves indispensable to existence, that is to *life*? Or who, in looking to the "acephalous"—the brainless monster reported by Lawrence, would venture to declare that the influence of a *brain* was necessary to the vital functions; that *it* was anything more than an instrument *of* life? In both instances we are supplied with the requisite data (facts) to demonstrate to us, as plainly and conclusively as can be demonstrated, the perfect and normal operation of the vital principle. We see the body nourished, the viscera perfected and the bony fabric matured; and we are assured, therefore, that circulation, absorption, secretion, &c., &c., have been in full operation, in perfect action, without either a brain or a spinal cord; AND WITH ONLY A GANGLIONIC NERVOUS SYSTEM.

I must indeed confess myself entirely at a loss to account for the peculiar opinions at this time held, and what is more, *taught* by some of our most eminent medical writers. I cannot for the life of me make out the reasons why men of such undoubted talent and industry as Drs. Roget, Müller, and Hall, among others I need not name, will still persist that "all experience shows that when the influence of the brain and spinal marrow is intercepted, although the afflux of blood may for a time continue, yet that the secretion ceases, and all the functions dependent on secretion, such as digestion, cease likewise" (Roget); that "the brain and spinal marrow must be regarded as the principal source of the nervous" (vital) "influence;" and "that the *anatomy* of these monsters" (meaning such as those mentioned above) "is *not* at present known with sufficient accuracy for any *conclusions* to be drawn from them" (Müller); and "that idiots with small brains are short-lived," because "the animal functions cannot go on permanently, independent of a brain;" "that the *amyencephalous* monster dies the very moment it is born"—"it cannot breathe, it cannot live an instant"—"because the brain and spinal marrow are directly essential to the continuance of the vital (vegetative) functions." However, so it is, and will be, it may be presumed, for some time yet to come.

I would beg the attention of Dr. Roget to the following few words—they are contained in a paper read by myself in the session of 1852-53, before the Medical Society of London, entitled "On the Physiological Uses of the Ganglionic Nervous System," being an abstract of certain articles which appeared in the columns of the *Lancet* in 1850, devoted to the same object as now engages my attention, and of which these pages are intended to be the exponent. At p. 11 of the pamphlet named, we find it written thus: "If I take an animal belonging to the higher species, *i. e.*, belonging to those the organism of which is similar to that of man, and

by an operation deprive it of both the brain and spinal cord, and yet leave the said animal in the possession of life, and in the full exercise of all those functions strictly called *vital*,—it must be conceded that the same must be not only independent of the cerebro-spinal system, but what is more, the immediate result of the integrity of the ganglia of the sympathetic nerve. I obtained a *frog*, and having removed the posterior parietes of the lumbar spinal canal, I introduced a small probe into the wound, and slowly passed it through the whole length of the spine towards the cranium; the contents of which, together with the cord itself, were entirely destroyed (the cerebro-spinal structure was, of course, annihilated). All sensation and motion of necessity ceased from that moment; and the animal appeared *dead*. This experiment was performed in 1845, and I made the following note at the time, viz., “It is *now* nearly *three hours* since this animal was operated on, and the heart is still to be seen, through the thoracic parietes, contracting as vigorously as in any other animal.” The following few words are appended: “In the absence of the cerebro-spinal functions, the animal before me is in a condition precisely similar to the amyencephalous monster of Hall, or to the mere polypus,” and in both of these, *i. e.*, the brainless and marrowless monster and in the polypus “the secretion” is continued, it does not “cease;” to borrow the words of Blumenbach. In fœtuses without brain or spinal marrow and, therefore, without any “influence” from such a source—not only is the *circulation* continued for a time, but “nutrition and secretion, &c., proceed equally as in others” with the cerebro-spinal organism complete in all its parts.

Müller may be, perhaps, best replied to in his own assertions and experience—he tells us that “in fishes the contractions of the heart continue for the space of half a day after the destruction of the brain and spinal

marrow.” Now *if in this instance* the cardiac nerves still retained a portion of the motor influence originally derived from the spinal column—as he (Müller) asserts is the case—and hence the “contractions” mentioned—how happens it that Rédi (the Italian anatomist) removed the *brain* of a frog, and that the animal lived “six complete months” after the operation; and that Sir B. Brodie removed the *spinal cord*, without in any way affecting the strictly vital or *organic* actions in those parts subordinate to it? Müller may be assured that our knowledge of the anatomy of the “monsters” he refers to *is* in every way “sufficient for the purposes of physiological induction;” and that precisely the same cause which enables the thoracic and abdominal viscera of the acephalous monstrosity to continue their functions—the identical source from which the heart and its vessels receive their power to circulate the blood; the liver to secrete its bile; the stomach to digest its contents; the intestinal absorbents to take up the chyle; and the kidneys to secrete their peculiar fluid—also empowers the organism of the decapitated animal in which the spinal cord has been also destroyed, to continue its specific action; the “*ultimate cause*” of the several phenomena of *life* is in both instances the same.

That *idiots* are short-lived is most true; but did it never occur to Dr. M. Hall that their cerebral imperfection is to be viewed as an indication rather of the mal-organized condition of the entire nervous organism, including the spinal and ganglionic not less than the cerebral? Is Dr. M. Hall prepared to say that the immediate death of the amyencephalous monster—the child without either a brain or a spinal marrow—is referable purely to the absence of a cerebro-spinal system? It dies truly “the moment it is born,” but not because the brain or the spinal marrow, or both of these organs, are directly essential to the continuance of *life*, regarded in the abstract, but because the respiratory muscles are powerless—

are in a state of complete inaction from the want of motor nerves : one essential element of vitality (life) is wanting to the integrity of the animal machine, and this cannot therefore continue in the exercise of its specific power or capabilities. The blood is not decarbonized, and the circulation of a poisonous fluid checks the vital energies of every part of the organism. The effects are the same, if a person with his cerebral and spinal functions in a state of nature (health) be made to breathe carbonic acid, or any other irrespirable gas. Life, in such a case of monstrosity as that just mentioned, cannot be said to cease from the want of any direct *cerebral* or *spinal* influence. Nor are the vital actions in the lower classes of animals which have no brain, and in those, too, which have neither brain nor spinal marrow, less completely performed than the same in man—*i. e.*, secretion, circulation, digestion, &c., are as elaborately and efficiently executed in the polypus and oyster as in man, but their breathing apparatus is more simple and independent of any addition to the organism, *i. e.*, independent altogether of a cerebro-spinal axis—whereby in man and the higher animals, including also the *amyencephalous* monster recorded by Dr. M. Hall, the nature of their dependence on, and relationship to, the external world are made manifest. The “child” here mentioned, if it may be so called, was, in point of fact, adapted only to an intra-uterine life; and incapable, therefore, of appropriating the materials of the external world to the requirements of its organism. I may here add, as a remarkable illustration of the *principle* which obtains throughout the animal world, that what is a mere *accident* to the fœtus, may be and is a palpable *design* among the lowest classes of animated nature; the *two*, as occurring to the *fœtus* and the *zoophyte*, not inaptly represent or embody the strong *analogy* which may be traced between any two or three or more of the links in the apparently interminable chain of being, and wherein

each part or link is so harmoniously arranged and adapted, not only to the requirements of the individual organism, but to the completeness of the whole. The organic similitude of the brainless and marrowless monster, and the common *medusa*, will be clearly apparent; the structure of the nervous organism in each one is alike, and composed only of the great sympathetic nerve, or of the analogue of the same. We may, in fact, with much propriety and truth, regard the permanent condition of the *medusa* as characteristic of the early and temporary, or accidental or acquired, condition of man.¹ In the very early period of foetal life, we observe nothing more than a gelatinous, shapeless mass, in which the microscope can nevertheless discover a nervous ganglion or ganglia. Life in both is, however, complete. To carry out the "principle," the *acephalous* (headless) being described by Mr. Lawrence is, organically speaking, on a par with the molluscous animals, or more properly, perhaps, with the *annelida*. Now, it is well

¹ In advocating this *unity* of the animal world, I am far from insisting on the doctrine attributed to Lamarck, viz., that the human embryo during its intra-uterine existence presents, at one period or another, the organic peculiarities of all the lower forms of vitality. The faith, in this much, it was which led to the idle stories told by Schenk, and others, in which women are represented as having been delivered of "polypi, echini, musculi, ostaci, bufones, serpentes, porceli, elephanti, talpæ, canes, lones, &c., &c." However, there can be no doubt, that in the words of Dr. Bushnan, "the foundation stones, as it were, of all animals are of the self same number and form, and upon these is reared a superstructure of the same character, but higher or lower, according to the rank which each individual being is to hold in the scale of creation." To each has the Creator said, "Thus far shalt thou go, but no further." Of some the progress has been very soon arrested, to others a greater advancement has been allowed, while in man, to so towering a height has it been permitted him to proceed, that he is tempted to deny his affinity with the rest, and to lose sight of the humble beginnings on which all equally rest. Mr. Coleridge in his 'Aids to Reflection,' draws the highest satisfaction, and indulges in the brightest anticipations, from the fact, that man begins thus humbly and

"Ascends

From small beginnings to a glorious end."

known that among the *medusariæ* every vital action is described as being conducted on the smallest scale, by the least refined methods, and with the strictest economy of means; *their* apparatus being the simplest, their agents employed the fewest possible, and their various operations being carried on in one and the same place; but as regards the *mollusca* or *annelida*, certain relations are very evidently exhibited to the surrounding media; and in these the external senses and voluntary motion gradually make their appearance, the organic apparatus necessary to the exercise of these functions being superadded. The *annelida*, like the acephalous monster just alluded to, is in the possession not only of a ganglionic nervous system but of a spinal.

From the foregoing remarks it is fairly to be concluded that if the nervous organism (*nisus formativus*) entering into the composition of the amyencephalous being of Dr. M. Hall, be sufficient for its creation, growth, and maturity,—or if, in other words, the ganglionic system of nerves be deemed either necessary or competent to create or preside over the vital actions indispensable to the perfect development of a brainless and marrowless monstrosity,—if the secretion, nutrition, circulation, absorption, &c., as carried on in it (in virtue of the said nerve-structure) are sufficient for its growth and entirety, and for the perfectibility of its several parts and organs—as the liver, spleen, heart, &c., and the consequent exercise of their functions; we cannot, by any possibility deny, or even so much as doubt, its power to regulate and preside over the vital actions necessary to the entire foetus. If the ganglionic nervous system have the power or capacity to develop and mature a liver, a heart, and a spleen, &c., and to excite them to the exercise of their appropriate functions in the animal economy, there can be no reason why it should not do so much, or the same, for a brain and spinal marrow.

Those who may be disposed to doubt the correctness of the

foregoing views, would do well to bear in mind that whatever defects may be found in the cerebro-spinal system of nerves, as it is demonstrated in the *monsters* to which so especial a reference is here made, the ganglionic nerve matter is rarely found in a condition else than normal; this fact is of immense importance in estimating the amount of evidence in favour of the doctrines I have ventured, in this small book, to put before my professional brethren; and if it be awarded its full weight, I cannot understand how the most sceptical can avoid yielding his assent to my propositions. Exceptions have, certainly, been taken to the "fact" here stated, but for this reason,—anatomists have not unfrequently, when pursuing their investigations into the nervous structures of the foetus, and of the lower classes of animals, mistaken the former, *i. e.*, the ganglionic nervous organism for the cerebro-spinal system; and hence have arisen many errors and fallacies which we should do well to abandon. "It is true," says Dr. Fletcher, "not a few accounts are on record of monsters, born at the full time, without any appearance whatever of a nervous system of any kind; but if we attend carefully to such accounts, we shall perceive that their authors have been in general employed in looking for a spinal cord and brain, and the larger nerves connected with them; and might easily have overlooked those smaller filaments which belong to the ganglionic system: and this seems the more probable, when we call to mind how long it was before this system of nerves, even in the most perfect examples of the highest classes of animals, was detected; and how recently the presence of nerves in the heart, upon which some of the most conspicuous filaments of this system of nerves are distributed, was resolutely denied. It is not, indeed, improbable that when the monstrosity is excessive the unformed mass may have its nervous system, as well as all its other organs—as is the case in quite the lowest tribes of animals—so generally diffused

as to be invisible ; but it is stated on good authority, and as the result of numerous and patient inquiries on the subject, that, so long as a human monster does not very considerably depart from the human form, the ganglionic system of nerves is in general, if not always, quite perfect."

The foregoing remarks, quoted from 'Fletcher's Rudiments of Physiology,' are confirmed by Lobstein, who, in his monograph "on the sympathetic nerve," relates, we are told, no fewer than six remarkable instances in which the brain and numerous other organs were deficient, but in all which the ganglionic system was quite entire, and in some more than usually developed. It is, moreover, important to the position here advocated—and confirmatory, in an eminent degree, of the truthfulness of the views entertained—that in Dr. Cayre's account of the dissection of nine idiots—we are assured that whatever was the amount of atrophy or disease presented by the cerebro-spinal system, he found "the ganglions of the sympathetic nerve, in general, perfectly healthy."

Sir Charles Bell is the author of the few following words, viz., "A blow on the pit of the stomach doubles up the bruiser, and occasions the gasping and crowing which sufficiently indicate the course of the injury—a little more severe, and the blow is instantly fatal. A man broken on the wheel suffers dreadful blows, and his bones are broken, but life endures—the coup de grâce is a blow on the stomach."¹ It

¹ The annexed very interesting and instructive remarks are from the 'Times' newspaper, viz. :

"NORWICH, WEDNESDAY, MARCH 22.

"CROWN COURT.—(*Before the CHIEF BARON.*)

"Richard Laws, aged 32, was indicted for feloniously killing John Smith, at Methwold, on the 7th of February last.

"*Mr. Hotson* was counsel for the prosecution, and *Mr. W. Cooper* for the defence.

"It appeared that the prisoner and others were spending the evening of the 7th of February, at the Cock Inn, at Methwold. Among the company was the

is very well known that whilst a comparatively slight blow on the epigastrium—over the *solar ganglion*—will sometimes cause death—very extensive injuries of both the brain and spinal marrow are not unfrequently borne with considerable impunity; for as I have before demonstrated, we can go so far even as to utterly and entirely destroy the brain and cord in the lower animals—and yet leave the “frog” in the exercise of all the strictly vital functions; but if we will reverse the position—if the cerebro-spinal system be left intact, and the solar ganglion be brought within the reach of physical injury, what follows? presuming that the violence

deceased, a Herculean corporal of the Guards, who, after the fatigues of a day spent in recruiting for the Russian war, had repaired with a promising recruit to that place of entertainment. In the course of the evening the recruit grew very valorous, and, to show how fit he was to thrash the enemies of his country, he challenged the prisoner, who, nothing loth, accepted the offer, and a fight was knocked up for 50s. a-side. The corporal, of course, backed the recruit, but, much to his disgust, the prisoner soon had by far the best of it, and would in another round have won the stakes, when the corporal interposed and said that “if the recruit was no match for the prisoner, here was a little chap (meaning himself) who was ready to lick him.” The prisoner thereupon agreed to transfer his attentions to the corporal, and they forthwith proceeded to fight. After a round or two the corporal planted a heavy blow on the forehead of the prisoner, who returned it with interest on his opponent’s belly. No sooner had this blow been struck than the gallant fellow fell back to the floor a lifeless corpse, to the amazement of all present. A surgeon was immediately called in, but he could detect no mark of external injury to account for death. The body was that of a fine healthy man, and, strange to say, the *post-mortem* examination disclosed no marks of internal injury. The surgeon to-day said that death under such circumstances could only be attributed to a sudden shock to the nervous system, which might follow immediately on the infliction of a blow on the stomach, at the back of which was the great nerve.

“The *Chief Baron* left it to the jury to say whether they thought the death of the deceased was occasioned by the blow of the prisoner given in the fight. If so they ought to find him guilty; but if they could not say what was the cause of death, or if they should think that the death was attributable to excitement, and was independent of the blow, the prisoner would be entitled to an acquittal.

“The jury deliberated a few moments, and returned a verdict of *Not Guilty*.”

employed is considerable, death immediately ensues: all evidences of life cease, consciousness, volition, sensation, motion, secretion, digestion, respiration, circulation, sanguification, calorification, all are extinct. The brain, the cord, and all parts of the organism, which in health subserve the same (life); the viscera of the chest, abdomen, and pelvis fail their wondrous offices. The heart, lungs, stomach, liver, intestines together cease their aids in this wonderful machine in man and animals; and all is then for ever over. The first and great *mainspring of life*, *i. e.*, the solar ganglion, has lost its energies, and all the instruments wherewith it worked its destiny, and preserved its relations to the external world, are therefore *dead*, and but waiting the operation of those eternal laws to which the physical world, in all its varieties, is made subordinate.

Now, the same "physical injury," or violence, instead of expending itself so generally (causing the death of the man or animal as the case may be) and involving the *solar ganglion* itself, may be confined to certain limits, and affect only certain of the smaller ganglia of the sympathetic nerve;—and when this is the case, the abnormal phenomena observed will be more or less partial—thus, if a careful and graduated pressure be made through the abdomen of the rabbit, on the upper part of the lumbar region (where the experimenter will avoid the solar ganglion) the lower, or rather the hinder extremities of the animal will presently become completely paralysed; the rabbit, when placed on the ground, will be seen to use its fore legs well enough, and with these it will drag itself to and fro—evidently much puzzled at its own sudden and unusual incapacity; however, after a few minutes, the spinal functions are restored, and the animal is as lively as ever. This is, if I mistake not, a beautiful illustration of the dependence of the vitality of certain portions of the lumbar spinal cord on the contiguous ganglia of the great sympathetic nerve.

Again, if in the frog, the *abdominal* ganglia only be removed from the animal, and the *thoracic* be left untouched, the true spinal functions of the anterior extremities will be found *comparatively* unimpaired; whilst those of the hinder legs will be, to all appearance, lost. Of course the frog very quickly dies, but nevertheless the experiment is sufficient to prove, inferentially, not only the fact just stated, but that the superior or thoracic ganglia have the power, in some degree, to continue the same action which they receive from the *solar ganglion*; to say nothing in this place of the measure of their *independence* as parts of the ganglionic nervous system.

My readers are, of course, well aware that an injury sustained by the superior cervical ganglion, in both man and animals, is productive of blindness—by arresting the vital actions (nutrition) going on in the eye.

In considering the effects of certain vivisections on animals, as well as the consequences of accident to man, in so far as both these involve more immediately the ganglionic nervous system, the attention is with much certainty arrested by the fact that in the *annelida* “their division into separate fragments does not destroy the organism, but, on the contrary, gives rise to the production of several distinct beings.”¹ This

¹ The remarks made by Dr. Carpenter, in reference to the structure of the *Dorsibranchiata*, are highly interesting; and from which it would appear, that in these animals the distinction or separation (partial) of the cerebro-spinal and ganglionic nervous systems is commenced; and that from this beginning, as from a fixed *point*, they each proceed, and are continued upwards through the ascending scale of creation. The words of Dr. Carpenter, moreover, explain in a highly satisfactory manner, how it is that the “fragments” named in the text, assume the characteristics of “distinct beings.” At pp. 366 and 367 of his ‘Principles of Physiology’ we read thus—“The nervous system of the ‘Dorsibranchiata’ presents the highest type which it anywhere attains in this class; the cephalic ganglia being much superior in size to the ganglia of the ventral cord, in virtue of the development of organs of special sense with which they are connected; and indications being observable of a set of nerves and ganglia appertaining to the digestive and respiratory organs, distinct from the proper ventral gangliated

circumstance is, in itself, highly interesting, and demonstrates to us the fact that the animal tissues (organism) at this par-

cord which is subservient to motion alone. Moreover, the two halves of the latter are closely approximated on the median line; but their ganglia are still usually bilobed. The multiplication of these ganglia is conformable to that of the segments, so that as many as five hundred double ganglia, repeating each other precisely in function and connections, are sometimes met with. The complex muscular apparatus of each segment is repeated in like manner. Notwithstanding this complex organization, we find, even in the highest *annelidæ* a remarkable power of regenerating portions of the body which have been cut off; and in certain species, which undergo spontaneous fission, the whole body is reproduced from the parts that are detached. This power is obviously related to the original mode of development of these animals; which, like the *tæniæ*, come forth from the egg without the least rudiment of a body; the formation of this being subsequently commenced by a process of gemmation from the posterior part of the cephalic segment (which at first almost resembles a ciliated animalcule), and being continued by the subdivision of the last segment that has been developed. This process would seem to go on, in some species at least, without any precise limitation; and in some of the *Nereids* we find the same detachment of egg-bearing segments from the posterior part of the body, which we have seen in the *tæniæ*; the chief difference consisting in this, that whilst in the *tæniæ* these segments are detached singly, and are unprovided with organs of locomotion, those now alluded to are detached in groups, each of them having a head and eyes, with the ordinary apparatus of motion, but their digestive apparatus being so imperfect, that these moving egg-sacks do not seem able to assimilate food for themselves. The resemblance of these *Annelidæ* to the cestoid worms, as regards their reproductive operation, is farther borne out by the universal diffusion of their true generative apparatus; the sexes not being distinct, and both male and female organs being repeated in every segment except the cephalic, and each discharging its products by an orifice of its own."

Now the *articulatæ*, like the *annelidæ*, have a ganglionated nervous cord, but the former may not be mutilated with the same impunity—their division into "fragments" is attended with immediate death; it would seem that the addition of anything like a distinct spinal system to the ganglionic constitutes the limit within which *nature* allows the divisibility of the vital principle, in the lower animals. The *articulatæ* may be said to possess not only ganglionic and spinal nerve-matter, but a medulla oblongata from which nervous branches arise which furnish the animal with certain external senses; and these establish so indissoluble a connection, and so direct a dependence on the external world, that the facilities which the animal enjoys more than compensate for the absence

ticular stage of development are sustained in their integrity, equally by the several *ganglia*, forming a part of the ganglionic nervous tissue; whilst in man, including the more perfect animals, the vital principle (the "*anima*") is *in great part* generated in a central organ (the *solar ganglion*), and from it diffused through the whole body.

It is rightly inferred that *life*, regarded in the abstract, is identical throughout all animate nature; in every genus, species, and variety; and in each individual of all three of these artificial divisions, "life" is seen, or rather *known*, in connexion only with an especial nervous apparatus; and that these stand in relation to each other as *cause* and *effect*, it would seem impossible to doubt.

The observations already made derive no inconsiderable confirmation from the ordinary phenomena of *disease*. A visit to the wards of any lunatic hospital will give one the opportunity of witnessing many cases in which not only the brain, but the spinal cord, have become so altered from their natural state as to realise, in the individuals affected, all the external signs of an incurable fatuity, combined with a loss, more or less complete, of the true spinal functions. The cessation of the cerebro-spinal phenomena (functions), from long-standing disease of the brain and cord, will be apparent in the attenuated, enfeebled, and paralytic objects with which the wards of every establishment for the insane abound. However, these same *objects* not unfrequently live several years without manifesting any of the ordinary signs of intelligence, or emotion, or passion—of either consciousness or volition—of either sensation or motion—else than what would of the *fragmentary* property. A step is, moreover, made towards that more perfect organism, wherein the increase in number and complexity of its parts tend, in an eminent degree, both to establish the responsibility of man himself, and to explain the nature and operation of those physical laws to which *he* must submit, if he would avoid the many miseries which press on him, from all sides.

appear to belong to some common *instinct*: but during the period which intervenes between the accession of the disorder affecting the brain and spinal cord, and their decease, such patients are enabled to continue all the strictly *vital* functions: the respired air is decarbonized, and the blood is circulated. The digestive organs fail not in the performance of their functions; secretion, absorption, and nutrition proceed in their accustomed course: in a word, the solar ganglion and its auxiliaries have not yet ceased to elaborate and to dispose of their peculiar stimulus to whatever portion of the animal organism is sufficiently intact to receive and appropriate the same.

The following few words from the pen of the late Dr. Cooke¹ are so appropriate to the present subject, and so eminently illustrative of the foregoing views and remarks, that I cannot do better than claim the attention of my reader to them. He writes thus—"Mr. Bell finishes the account of paralytic affections with which he has favoured me by proposing some questions which I am unable to answer; but which I insert here as containing a striking description of certain facts:— 'Let me ask you,' he says, 'what is the nature of that sudden interruption to the growth of parts, which we so frequently witness? A finger, an arm, a leg, one side of the face, one eye, one testicle, will be suddenly interrupted in its growth; in the mean time the individual increases in stature, and we find at length the arm or leg of a child, as it were, unnaturally joined to an adult; although there is no paralysis, no want of muscular motion, yet is it not owing to an affection of the *nerves* of the part?' " I would in all deference suggest, for the calm consideration of my medical friends, that the cause of the affection, although located in the nerves of the part, is not to be found in the cerebro-spinal nerves, but

¹ See his work on 'Nervous Diseases,' vol. ii, p. 104.

in the organic or ganglionic nerve-matter. This, for some reason or another, is prevented from continuing the necessary supply of nervous energy to the affected part, and hence it is that the arm or leg, &c., is no longer duly nourished, and its development so signally arrested. Monstrosity of this and of every analogous kind, is plainly enough to be referred to the same cause; *e.g.*, congenital idiocy (cerebral paralysis) is nothing more or less than an indication of the cessation or interruption, in some way, of the nervous energy of the great sympathetic; and, as a consequence, the "hemispherical ganglion"¹ (in utero) is arrested in its development, and "at length," the *brain* of a child is, not unfrequently, "unnaturally joined to an adult."

It is then to be concluded—judging from the effects of accidental injuries and experiments, and not less from pathological investigations and facts—that all and whatever causes which either impair or destroy the ganglionic nerve-matter, very materially interfere with or *arrest the vital actions in man and animals*: in other words, produce *death*. Both the presence and entirety of the ganglionic nervous system are indispensable to healthy action, *i. e.*, *life*; and either the absence (*removal*) or disintegration of the same portion of the organism, is incompatible with vitality, and reconcilable only with *death* (physical annihilation).

It is now very many years since, that Sir Benjamin Brodie, in order to test the sources of nutrition, growth, and the reproduction of lost parts, performed various experiments on different animals; these had reference principally to the cerebro-spinal nerves, and their influence on the important vital acts named. These experiments proved beyond all doubt that the reparation of injuries, both of the soft parts and of the bones (including fractures), was effected *without* the aid

¹ Solly.

of any cerebro-spinal influence. Frogs, guinea-pigs, cats and dogs, were the subjects of his experiments, and in each of these either the spinal cord was destroyed, or portions of the crural and sciatic nerves were removed; and on wounds and fractures being made in the extremities so deprived of nervous influence, the same were found to suppurate, heal, and unite, not less readily and completely than under all ordinary circumstances. Sir B. Brodie thus records his experience; viz., "a portion of the anterior and posterior crural and sciatic nerves was removed, in a dog, in the upper part of the thigh; the limb, of course, became immediately benumbed and paralysed. A wound was then made in the leg, and the claws of all the feet were cut so as to make them of the same length. The wounds suppurated and healed as readily as if the nerves had been entire. At the end of seven weeks I measured the claws of the four feet, and found that those on the paralysed feet had grown equally with those of the others." This experiment, we are informed by Sir Benjamin Brodie, he repeated on guinea-pigs, and with the same results. In one of them the tibia was broken, and the bone readily united.

"The posterior part of the spinal marrow of a frog was removed, so as to destroy the origin of the nerves of the lower extremities. In this case the bones of one leg were broken, and when the animal was killed the bones were found united, partly by callus, and partly by bony substance."

On reference to Müller's 'Physiology' we learn that Drs. Sharpey and Schroeden have repeated the above experiments as performed by Sir Benjamin Brodie; and that these eminent men have realised precisely similar results. Now it has been very generally asserted and believed that the eighth pair of nerves exercises an important, nay an indispensable, aid to the gastric function—that the integrity of the *par vagum* was a *sine quâ non* to *digestion*; but, thanks to the originality and researches of Drs. J. Reid and Magendie, we know well,

at this time, that "the nerves of the par vagum are by no means necessary to digestion," provided only that their division is made in such a manner as not to affect the respiration, and the free oxygenation of the blood. We know, moreover, at this time, that, as Sir Benjamin Brodie has long since taught, the process of *secretion* generally—which includes, as a matter of course, that of the *gastric fluid*, a primary and essential element of the digestive function—must be referred, not to the cerebro-spinal organism, but to the ganglionic nerve structure, or, what is the same thing, to "the same class of functions as those of nutrition, growth," &c. The following experiment confirms, in the most satisfactory manner, the facts just stated:—"In a young cat, the terminations of the nerves of the eighth pair on the cardia of the stomach were carefully divided; the animal was perfectly well afterwards; was lively; ate its food as usual; and the respiration was not affected. At the end of a week, and three hours after having been fed with meat, the cat was killed. On dissection, digestion was found to be going on as usual; the food in the stomach was in a great measure dissolved; and the thoracic duct and the lacteals were distended with chyle, having the ordinary appearance. The nerves were carefully traced, and it was ascertained that not the smallest filament had been left undivided. This experiment was repeated with exactly the same results." (See 'Cooke on Nervous Diseases,' vol. 1, p. 130.)

A moment's reflection on the vivisections here given, is alone sufficient to assure us that the recovery of the wounded dog, equally with the reparation of the fractured legs in both the guinea-pig and frog, and not less the digestion of the hearty meal by the *cat*, were severally due to the integrity of the ganglionic nervous tissue; this was, in each of the instances cited, left intact; and there could be no reason, therefore, why the incision in the dog's leg should not

heal—why the broken bones in the guinea-pig and frog should not unite—and why the meat in the mutilated *cat's* stomach should not be digested—“dissolved.”

I may remark here that it does not anywhere appear that even Sir Benjamin Brodie or any one of the many commentators on his experiments had any idea whatsoever that the valuable facts mentioned above did more than establish a negative; neither himself nor his contemporaries have even so much as suggested the legitimate and *positive* conclusion to be drawn from the same. It seems strange that it did not occur to Sir B. Brodie, with all his genius and large experience, to draw a parallel between the acquired or accidental organic condition of the mutilated animals here named, and the congenital organism of the malformed foetuses (monstrosities) recorded by Mr. Lawrence and Dr. Marshall Hall; in which, as is well known, the cerebro-spinal system was more or less wanting: to say nothing of the natural condition of the common *medusa* and of the helpless frogs and “fishes” mentioned in these pages—and so hardly treated by Rédi and Müller. In each one and all of these instances named the organic nervous system was in the exercise of its normal functions, and the vital phenomena, as nutrition, secretion, &c., were continued in all their perfection and harmony.

As an instance of the strange pertinacity with which Müller is prepared to advocate the cause of the cerebro-spinal system of nerves *versus* the ganglionic, and to draw conclusions from incorrect and insufficient data; in short, *to show that the organic nerves do not influence nutrition*, I will quote the few following words, viz., “where any organ is wanting, there is always a corresponding absence of their *nerves*” (meaning the cerebro-spinal nerves) “absence of the eyes is attended with an absence of their nerves.” Now, unhappily for the theory of Müller, in this particular instance, I am in a position to

positively contradict the fact as stated. I would beg to offer for the consideration of the reader the following quotations from a report of my own, to be found at page 293 of vol. ii of the 'Lancet,' for 1835 and 1836; concerning the *post-mortem* examination of a child born without eyes: "On raising the anterior lobes of the cerebrum but *one* olfactory nerve was seen, and this was on the left side; the optic commissure was placed more posteriorly than natural, the sella turcica being much anterior to it. From its fore part, and in the median line, the rudiment of a nerve was continued, it was of a loose texture, and of a scarlet hue, as if from injection of its vessels. It proceeded into the substance of the pituitary body, in which it was lost. Several small blood-vessels passed through the foramen opticum; the fissura lacera transmitted both into and out of the orbit, the ordinary nerves and the ophthalmic vein." "The orbital roofs were then removed, and disclosed the presence only of condensed cellular tissue, which, when cautiously dissected away, exposed the several small muscles which naturally belong to the organ of vision, supplied by their respective nerves."

I cannot look on the other arguments of Müller in favour of the doctrine which assigns to the cerebro-spinal axis the office of *nutrition* in a more favorable view. He writes thus—"although the nutrition of monsters 'is by no means defective,' but their development up to the period of birth even *perfect*, yet is there no proof that the sympathetic nerve has a more especial influence on *nutrition* than the cerebro-spinal nerves, *except*, perhaps, the fact that the nutrition of a part does *not* cease when the nerves which it receives from the brain or spinal cord are divided." I would add—if the sympathetic nerve had *not* a very much "more especial influence on nutrition than the cerebro-spinal nerves," we should not find that its partial removal or rather *destruction* would be so invariably prejudicial, even *fatal*, to certain parts

or organs as it is ; or, in other words, we should not find that disease of, or injury to, the superior cervical ganglion arrests the nutritive processes going on in the *eye*. In either case the branches of the third, fourth, fifth, and sixth pairs of nerves, normally distributed to the contents of the orbit, are untouched and left in the full exercise of their healthy action ; but, nevertheless, the eye loses its vivacity and becomes disorganized ; the vital phenomena cease, nutrition is suspended, and the organ at length presents only a mass of atrophied animal matter.

In this instance, however, Müller is singularly inconsistent with himself, for at the same time that he contends for the dependence of the *organs* and the cerebro-spinal nerves on each other for their existence, he cautions his reader from concluding that the production of the former depends on the pre-existence of the latter, and adds, with great truth, “ both organs and nerves are produced by the same power, the ‘*nisus formativus*,’ which resides undivided in the germ.” This *nisus formativus* or “ internal power ” is, we are told, the *cause of the continued* reproduction (nutrition), as it were, of all parts of the animal fabric, which, in the adult, is effected only by the process of assimilation ; that is, by the union of new matter with the assimilating parts, while in the embryo, in which no organized “ groundwork ” (Müller) as yet exists, the parts are formed, their *groundwork* is, in fact, created by the formative power, “ which is still undivided.” “ For although, until the whole body perishes, all the organs are directed by *one formative principle*, which produces the concurrent action of all assimilating tissues, and the operation of which we admire, as the *vis medicatrix naturæ*, in the correction of the subtile material changes which are induced by disease ; yet organized parts of the body, once formed, cannot in most cases, if wholly destroyed, be again restored by this power—this vital organizing principle.”

From the facts here stated, and from the observations already made, it is concluded that both the ordinary *nutrition* and, what is more, the *reproduction*, equally with the decline (atrophy) or decay of the organism (the very converse of the nutrient process) must be attributed only to the operations of the organic or ganglionic nervous system; and that the nutrition of all parts of the body, in man and animals, in conformity with the original type, presupposes the persistence of that power which originally produced all the distinct parts, all the organs, as "members of one whole;" as parts necessary to our idea of the being; and which is present in the germ before any distinct organs are formed, and while the animal exists merely "potentially." (Müller.)

It appears then that the "formative power" of Blumenbach and Müller, or the *materia vitæ* of Hunter, call it by what name we will, is no less universal than the animal organism itself; and there can be no doubt that, like the animal organism, it observes corresponding varieties and gradations, &c. It could hardly be expected that the "formative power" of the dog is similar to that of the man; or that of the fish, of the reptile, and so on, through the whole of living things. The "*germ*" and its product must possess qualities common to both. It is impossible, perhaps, to demonstrate the specific or *physical* characters of this "formative power" in man or in animals, peculiar either to the same or to different species of each genus; yet is there an abundance of reason to conclude that a positive difference must everywhere exist. The formative power, &c., regarded as the *germ* of all to be afterwards developed, may be said to represent in its successive changes in *utero*, its various and permanent conditions as they exist throughout the animal kingdom;—beginning with the polypus, in which every vital action is conducted upon the smallest

scale, by the least refined methods, and with the strictest economy of means; its apparatus being the simplest, the agents employed the fewest possible, and its various operations being carried on in one and the same place; proceeding in the mollusca, and in worms and insects, in which relations are exhibited to surrounding objects, and in which animals the senses and voluntary motion gradually make their appearance, the organic apparatus necessary to the exercise of these functions being superadded; ascending through fishes, reptiles, birds, and quadrupeds, in which the powers of sensation and motion become much more energetic, much more active, the internal life at the same time more and more developed, and the cerebral functions more and more numerous and diversified; and ending with *man* himself, in whom, as Blumenbach observes, the successive imposition of cerebral matter has reached its maximum, so that the summit of the nervous system, which corresponds with the forehead and vertex, is much larger in him than in any brute, and his intellect and moral feelings are proportionally greater.

Apropos, the comparative cerebral development of man and brutes is, as is well known, employed to mark the rank any one of either kind may hold in the scale of creation and intelligence, and very properly so; but it appears to me that, herein, the physiologist takes cognizance only of an *effect*, and that this has resulted from the operation of a cause which he has hitherto failed to appreciate. Nothing can be more true than that "the higher we ascend the more parts exist above the *medulla oblongata*, till, rising from fish and reptiles, through the numerous warm-blooded brutes—all distinguished by the relative magnitude of each cerebral part—we arrive at man," the "summit of terrestrial objects;" and it is equally true to my mind that the successive increase of parts above the *medulla oblongata* is attributable

to the operation of a preliminary cause, viz., the "formative power," or the ganglia of the sympathetic, *the germ of all animal life, whether cerebral, spinal, or organic*. On tracing the animal organization from above downwards, we observe generally a gradual diminution or simplification of parts, and which in every case is proportionate to the wants and adaptations of the animal. The decreasing cerebral organism, for instance, marks the downward progress of the animal in the scale of intelligence and feeling. This is seen throughout the vertebrated animals, as the mammalia, birds, reptiles, and fishes. The insect tribes generally can hardly be said to have more than a mere rudimentary brain; they have certainly a *medulla oblongata*, in which the nerves of the external senses take their origin. The spinal system, so far, is perfect in all its parts, and all the strictly vital functions are in full operation. In the annelida, however, we mark a very considerable falling off; the absence of everything like a brain, and of the external senses, leaves the animal to exercise only a strictly spinal and ganglionic existence. The excito-motory function, in itself, seems perfect, and, like it, the organic functions appear on a par with those of the mollusca. The only advantage of the annelida is probably in its means of progression. One more step downwards, and the ordinary medusa is seen a mere mass of living gelatinous matter, without the least indication of even a spinal life, but nevertheless executing the organic functions of assimilation, digestion, secretion, circulation, nutrition, absorption, &c. This last step of the ladder constitutes the first of the intra-uterine life of the foetus; and it may be said that just so many steps as it takes the physiologist to trace the successive and organic changes from man to the medusa, the same are required to trace the foetus through its various metamorphoses during its intra-uterine existence; and there can be no doubt, as has been before observed, that

each diminution or addition of parts, both in man and animals, is but the visible effect of a corresponding variety and gradation of the *nisus formativus*, the *germ* of all to be afterwards developed. It may be added that the possession of the *three* nervous systems in man and in the higher order of animals does not pre-suppose that those which have only *two* or even *one*, have been insufficiently provided for. The organism of the polypus and oyster is as nicely adapted to their wants and the circumstances which surround them, as is the organism of man.

The phenomena of *sleep* may be in themselves regarded as beautifully illustrative of the independence of the ganglionic nervous system ; and, as it were, of a natural line of demarcation between it and the cerebro-spinal system. In sleep the animal functions are suspended ; the brain and spinal cord may be said to be in a temporary state of death, or suspended animation. The individual in a sound sleep—that is during really healthful repose—neither sees, hears, smells, tastes, nor feels. His intellectual powers, no less than his affections and propensities are, for the time being, annihilated ; his consciousness has fled. *Respiration* and other processes, are, however, continued ; though with less activity and energy than at other times. The *involuntary* functions, as the *vital* are commonly designated, admit of no cessation ; and they are, therefore, not entrusted to the volition of the individual.

“If we consider,” says Dr. Von Feuchtenzleben, of Vienna, in his ‘Principles of Medical Psychology,’ “what takes place during sleep, we find—

“1. A suspended communion of the mind with the external world.

“2. A continuance (consequently *pro tempore* predominance) of vegetation, whence awaking appears as resuscitation. We see, therefore, in sleep, on the physical side, vitality lowered in the organs of sense and motor nerves, and at the

same time continued in the vegetative nerves; on the physical side spontaneity checked in its manifestation for want of external images conducted to the brain through the sensitive nerves. Thus viewed, the phenomenon and many of its peculiarities receive an explanation. In a teleological point of view, sleep appears to be a repose of the proper instruments of thought, by which, not only these, but also the rest of the corporeal vitality, to which the psychical world is an internal, as the outward is an external, excitement, are refreshed. "*The masterpiece of creation,*" observes Lichtenberg, "*must, for a time become a plant, in order to be enabled to represent, for a few consecutive hours, this same masterpiece of creation.*" Sleep, in short, is an affection of the cerebro-spinal system—the ganglionic nervous system never sleeps."¹

In reading the observations immediately preceding, it may occur to the mind that *respiration is hardly to be considered as an involuntary function, and, as an effect of the operation of the great sympathetic nerve*—as, in point of fact, a function of that portion of the organism; but it should be well remembered that—in the words of Mr. Grainger—"birds, and even dogs, and other animals, have been known to survive the division of the *nervus vagus* for several days." It is true that in order to prove the act of respiration to be dependent rather on the cerebro-spinal system, than on the ganglionic nervous structure—certain physiologists have asserted and maintained that in the several instances cited by Mr.

¹ With regard to "sleep," I may as well mention here, that the late Dr. Binns, in his 'Anatomy of Sleep,' argues that inasmuch as "no phenomena can arise, or can manifest themselves in the body purely from the cessation of activity of any organs, but must owe their presence to some direct cause, therefore may *sleep* be described as a positive function of a certain portion of the animal organism, as, in fact, a "faculty" which "resides exclusively in the ganglionic system." However, I must still prefer to consider sleep as "a negative state of existence," and as the index to, or rather the result of a state of fatigue of the cerebrum.

Grainger, the respiratory function was continued through the agency of the brain—that is, by *volition*. How this same *agency*, i. e., *volition*, could be continued, even in birds, or in dogs, or in other animals so mutilated, “for a period of several days,” and without a moment’s intermission, I must leave to others to determine.

It is true that Bichat describes the act of *respiration* as a mixed function; i. e., as neither altogether voluntary nor involuntary; ‘a function placed, as it were, between the two lives, to which it serves as a point of contact, belonging to the animal life by its mechanical functions, and to the organic life by its chemical functions.’ The same author adds—‘As soon as the human brain ceases to act, the functions of the lungs are suddenly interrupted. This phenomenon, which is constantly observed in the red and warm-blooded animals, can happen only in two ways—first, because the action of the brain is directly necessary to that of the lungs; or, secondly, because the latter receives from the former an indirect influence by means of the intercostal muscles and diaphragm—an influence which ceases with the activity of the cerebral mass.’ It is *not* so clear that the cessation of the cerebro-spinal function is fatal to the act of *respiration*; for during sleep, however profound, the lungs continue to perform their allotted office in the animal economy; both the necessary chemical changes are then effected in the blood, and, what is more, the respiratory muscles are kept in full play. Their influence, then, does not cease ‘with the activity of the cerebral mass.’ It must be, I think, assumed as an incontrovertible fact, that the par vagum, or eighth pair, is no more *indispensable* to the integrity of the *respiratory function* than it is to the act of *digestion*; and however necessary the motor influence of the various cerebro-spinal nerves supplied to the respiratory muscles, as they are termed, may be, and is, as a general rule, to their normal action, yet does it appear, for

Reflex

various reasons, that the alternate contraction and dilatation of the thoracic cavity, the effect as it is of muscular power, exerted on its parietes, may be, *under certain circumstances*, continued independently of the cerebrum and spinal cord. The act of respiration, then, is, *strictly speaking*, an organic function; else, during *sleep*, and in cases of disease affecting the entire brain and cord, as in the peculiar paralysis of the insane combined with idiocy, wherein the cerebro-spinal functions are one and all obliterated, the lungs must cease to act. Inasmuch as *insects* receive the air by points which open externally, the function of respiration belongs to them entirely, and at all times, to the organic life; in man, it constitutes, *as a general rule*, one of his many relations or *adaptations* (Combe) to the external world.

“A principal object,” says the late Dr. Wigan, in his able and learned work, entitled ‘The Duality of the Mind,’ “of the ganglionic system would seem to be, to carry on the functions of life during sleep, like the additional spring to a watch to enable it to go while winding up.”

The state of the sphincters during *sleep* must assure us that *they* are primarily and essentially under the influence of the organic nerves. The closed state, for instance, of the rectum and bladder, is, like the action of the heart or peristaltic motion of the intestinal canal, an *involuntary* act, which, under certain circumstances, is successfully opposed by the *volition*; in which case the cerebro-spinal functions may be said to take the precedence. I may be permitted to add that the analogy, physiologically considered, between sound sleep and the ordinary mesmeric coma cannot fail to arrest the attention of any one practically acquainted with *animal magnetism*.

With the foregoing facts before us, it *cannot* be made to appear that “when the influence of the brain and spinal marrow is intercepted, although the afflux of the blood may

for a time continue, yet the secretion ceases, and all the functions dependent upon secretion, such as digestion, cease likewise." Dr. Roget adds that "experience" also shows that "the functions of digestion, circulation, absorption, secretion, and all those included under the class of nutrient or vital functions, are carried on as well during sleep as when we are awake;" that is, as well during the total *inaction* of the *brain* and *spinal marrow*, when the "influence" of both must, of course, be "intercepted!" *Strange experience this.*

The subject of *animal heat*, its source and nature, has always attracted a very large share of the attention of physiologists. It must be confessed, that up to the present time the general views advocated are by no means satisfactory. Before giving my reasons for believing that the ganglia of the sympathetic are the source from whence the animal heat is derived, I will briefly dwell on the published opinions on this disputed topic of physiological science.

The fact of living animals being enabled to preserve a degree of *heat*, to a great extent, independently of surrounding circumstances, very naturally led physiologists to inquire into its origin. Whilst on the one hand, it has been maintained that *animal heat* must be referred to certain chemical changes occurring in the lungs during the act of respiration; on the other, it has been urged that the source of it must be in the organic or vital processes generally. It was taught by many eminent physiologists and chemists, amongst whom I may mention Lavoisier, Laplace, and Crawford, that the oxygen of the atmosphere combines in the lungs with the carbon of the blood, and is expired in the form of carbonic acid; and that the caloric developed during the combination of the oxygen with the carbon was the cause of the animal heat. Many writers on this interesting subject have naturally enough objected to this theory, on the ground that it was

difficult to understand how a cause which was limited to one organ of the body, should produce an elevation of temperature, which in general is diffused over the whole frame. Alison and Stevens have considered this objection of great weight, and the latter has been induced to offer a very different chemical explanation to the above. Dr. Stevens attributes the source of animal heat to the chemical combination of the carbon of the venous system with the oxygen of the arterial obtained by inspiration, but taking place in the secerning vessels.¹ Müller assures us, too, that the more recent theory of Dr. Stevens is supported by the experiments of Bischoff and Magnus. But, however much or little of the animal heat is referable to chemical causes, yet is it certain that it must have some additional source. Impressed with this conviction "some physiologists, and among them Professor Von Walther and Dr. Paris, have thought to find a principal source of animal heat in the different secreting processes, by which fluids having a less capacity for caloric than the blood are separated from the latter fluid, since caloric, before latent, must thereby be rendered sensible. According to Dr. Crawford, the capacity of milk for caloric is less than that of the blood. Dr. Paris estimates the capacity of urine for caloric at 0.777; that of arterial blood at 1.003. The conclusions of Crawford and Paris are, however contradicted by Dr. Davy and other authorities.

M. Pouillet, according to Müller, affirms that animal heat depends on the moistening of the organic structures by their several fluids; thus the gastric juice in contact with the mucous membrane of the stomach is the cause of heat in that organ, and similarly of the urine and its recipient organ, the bladder, &c.; "all solid bodies, inorganic as well as organic,

¹ See Dr. Stevens's work on the Blood, and my papers on the Pathology of Fever and Cholera, in 'The Lancet,' for 1835 and 1836.

undergo an elevation of temperature when moistened with different fluids."

A great variety of experiments have been performed by Brodie, Philip, Le Gallois, and Chaussat, including other physiologists of eminence, in order to determine the influence of the cerebro-spinal system on the generation of animal heat. They are, however, by no means demonstrative of the agency of either the brain or spinal cord in its production. Whilst Sir B. Brodie, on the one hand, has declared that the removal of the brain causes the temperature of the animal to fall, Dr. M. Hall says he has observed the very contrary of this—"he found that a decapitated animal retains its warmth." Emmert, we are told by Müller, repeated Brodie's experiments, and found a change of temperature of only $63^{\circ} 40'$ Fahr. in the space of 74 minutes.

The temperature of foetuses born without brain is maintained during the few days they may live.¹ Professor Rudolphi remarks, that the temperature of animals bears no proportion to their nervous system—meaning, it appears, the cerebro-spinal system; that if it did, man should be warmer than any brute; the mammalia much more so than birds; fish much more so than insects; and birds and amphibia nearly upon a par,—all which would be the reverse of facts.

The experiments of Le Gallois and Philip on the spinal cord show us that that organ exercises but a subordinate influence on the generation of animal heat. Although we are assured, by Horne and others, that the division of the nerves of a limb is attended by a diminution of temperature, and by Earle, that he found the temperature of the affected limb, in a case of hemiplegia, 22° Fah. below that of the sound one of the opposite side of the body; yet we have the authority of Breschet, Abercrombie, and Elliotson, that exceptions are neither few

¹ See Elliotson's note to Blumenbach, p. 170.

nor far between. The last-named writer has these words :
“ Parts perfectly paralysed still maintain a temperature above that of the surrounding medium, as well as circulation, secretion, &c., *and sometimes the same as in health.*”

From the above observations we are bound to conclude that the real source of *animal heat* yet remains to be demonstrated. I do not think that the unprejudiced observer will feel else than satisfied with the views about to be submitted to him.

1842 Nearly three years after the publication of my paper on the Physiology and Pathology of the Ganglionic Nervous System, in *The Lancet*,¹ I found it stated, in Müller's ‘ Physiology,’ that “ Chaussat endeavours, lastly, to prove, that the sympathetic nerve also has a great share in the production of animal heat. He found, that after injury of the splanchnic nerve, produced in the extirpation of the supra-renal capsule through a wound, which, he says, was not very large, the temperature gradually fell from 104° 88' to 78° 8' Fahr., during the ten hours which preceded death.” Now, I am quite prepared to admit that the experiment of Chaussat cannot be regarded as unobjectionable. The mere wound was too well calculated to produce the diminution of temperature observed. We all know, too, that not unfrequently a similar effect is produced from a simple finger-cut. Every one has seen symptoms of syncope with cold perspiration and nausea, and even sickness attend on the receipt of trifling wounds, or the extraction of a tooth, &c.

A much more satisfactory way to prove the dependence of animal heat on the sympathetic nerve is to observe the effects of a trifling blow, or even pressure, on the position of the solar ganglion. There are few of us who cannot remem-

¹ In the paper mentioned, I ask, “ Do we doubt that the solar plexus is the principal, nay, the only, source of animal heat ?” (‘ The Lancet,’ vol. i, 1842, p. 121.)

ber, when in our boyish days, to have suffered from blows on the epigastrium; I can easily do so, being at that time of a decidedly pugilistic temperament. From my personal experience in the matter, I certainly do not recommend the experimentalist to try the effect on himself; but should he be unluckily called on at any time to stand in self-defence, he may be assured there will be little to fear, if he only succeed in making out the solar ganglion of his adversary. When he has thus subdued him, if he will be at the trouble to mark the symptoms of the case, it will be seen that both power and inclination to do harm are lost. The patient can neither see, hear, feel, nor move; the heart's action has become so feeble that the pulse at the wrist is hardly perceptible. The countenance looks retracted and pallid, and the features shrunk, and death-like. The body is covered with a *cold* clammy perspiration; the stomach may probably have thrown off its contents, the pupils are dilated, and the eyes widely opened, and starting, as it were, from their sockets. Such are the effects of a temporary paralysis of the solar ganglion caused by *concussion*. Throw a stimulating enema into the large intestines, convey some brandy into the stomach, and apply turpentine or mustard poultice to the epigastrium, and you will probably see the lost temperature of the body restored, and with it the cerebro-spinal, and other animal functions.

The effects of pressure over the solar ganglion are well illustrated in a rabbit. With a little practice, one may beautifully demonstrate the successive and increasing effects of pressure over the organ just named. The first phenomenon observed is generally a loss of motive power of the hinder legs. This loss of power slowly diffuses itself over the whole body; the cerebro-spinal functions appear the first to suffer, and the last to recover themselves. THE ANIMAL HEAT IS VERY SENSIBLY DIMINISHED, *though much less so in the centre of the body than elsewhere.*

Müller says :—" The first point of interest in this inquiry," meaning the source of animal heat, " is the difference of temperature of different parts of the body. The temperature is lower the farther removed the part is from the *centre* of the body. Thus, in the human subject, a thermometer placed in the axilla stood at 98° Fahr. ; at the loins it indicated a temperature of 96½° ; on the thigh, 94° ; on the leg, 93° or 91° ; and, on the sole of the foot, 90°. Dr. J. Davy found the temperature of the rectum higher than that of the *brain*." Müller, it seems, doubts it, because, it would appear, *he* considers the brain as the source of animal heat. The rectum is not so distant from the solar ganglion as the brain, and its temperature, therefore, must necessarily be higher.

Judging, then, from the morbid effects of injury to the ganglionic system of nerves, as indicated as above explained, by a suppression of all the animal functions, as well as by a diminution or suspension of animal heat, we are bound to acknowledge with M. Chaussat, that, as a general rule, the injuries of the nervous system, which lower the *temperature* of animals, are the same which manifestly diminish the processes of secretion and nutrition.¹

Herein then we have facts upon facts to prove that the solar plexus, or the central organ of the ganglionic nervous system, is the principal source of such several vital phenomena—viz., *secretion, nutrition, and animal heat*.

I need not repeat, that *the temperature of fœtuses born without brain is maintained during the few days they may live*.²

¹ See Alison's 'Outlines of Pathology,' p. 158. It is well known that the animal heat is invariably increased after a meal; the activity of the digestive process keeps pace with the heat of the body, being dependent, as they both are, on the same portion of our organism.

² Turner, in his 'Sacred History of the World,' argues that the "principle of life is independent of the nervous matter, as it continues in the body for some time after the brain and spinal marrow are removed;" and in illustration of this position, quotes the following from a journal of October 10, 1829. The passage

In considering the subject of animal heat, the physiologist cannot help being particularly struck with the great increase of the heat of the body of birds, particularly of the common hen fowl, during what is called the *storge*,¹ or the period of sitting; so also of the quadruped, as the horse and dog, during the genital excitement. It is quite out of my power to offer any more demonstrative facts, to prove that this increased temperature of the body of the animal is the effect of an altered action of the ganglionic nervous system; but inasmuch as so peculiar a condition of both the bird and quadruped is unattended with any recognisable action of the brain or spinal cord, to enable us to explain the phenomenon in question, there is a strong negative reason why the increased *animal heat* should be referred to the operation of the organic nervous structure.

I have before endeavoured to show that the *nisus formativus*, or the organizing principle, constitutes in its developed or matured state the *solar ganglion*—including the ganglia of

also appeared in 'The Lancet':—"M. Wernhold cut off a cat's head, and when its arterial pulsation and muscular movements had ceased, took out the spinal marrow, and filled up its canal with an amalgam of mercury, silver, and zinc. Immediately the pulsation recommenced, and the animal made a variety of movements. In another cat he removed the brain and spinal marrow, and filled the skull and vertebral canal with the same metallic mixture. Life appeared to be instantly restored. The animal lifted up its head, opened and shut its eyes, looked with a fixed stare, endeavoured to walk, and whenever it fell, raised itself again on its paws. It continued in this state for twenty minutes, when it fell down, and remained motionless. During all this time the circulation of the blood appeared to go on regularly, the secretion of the gastric juice was more than usual, and the animal heat was re-established." It may be observed, in this place, that among the lower classes of animals—the serpent tribe, for instance—the *animal heat* partakes of the same character as belongs to the circulation, respiration, digestion, &c.; that is, they are alike *feeble* and *inactive*.

¹ The *storge* is an *instinctive act*, peculiar to birds, &c.; and the great *animal heat* which attends it affords reason to conclude, that both instinct and animal heat have one *common* cause or origin.

the great sympathetic. In the preceding observations I have also stated that the principle of *life* emanated from the same source as the *animal heat*. Now, in this opinion I am supported by the fact, that the eggs of birds and insects are cooled and frozen with more difficulty than equal masses of inanimate matter—although, when once frozen, and their life destroyed, they freeze readily. The destruction, then, of the *nisus formativus*, or organizing principle, by preventing the further evolution of *heat*, allows the egg to be frozen more readily. It may not be generally known, that such eggs as are impregnated, are confidently asserted to be easily distinguished from such as are not, by merely the increased temperature of the globular end of the egg. However, nothing is more certain, than that what may be called the apex of the egg is generally, or as a rule, much colder than its other end; and that the exceptions are rejected by the breeder of fowls, &c.

Animal heat is no doubt essentially a vital process, and not a chemical one. The chemical changes effected by respiration are inseparable from the nervous energy of the lungs, which is derived exclusively from the organic nerves. I cannot at all understand how “the production of animal heat must be as evidently a chemical process as changes of temperature among inanimate bodies,” for whatever heat may be produced by the formation of carbonic acid in the lungs must be immaterial. The lungs are, “in no sense,” “the focus of the heat of the body,” but the mere instruments, by the aid of which the blood is preserved in a fit state for circulation. To assert that the chemical changes produced in the lungs are the cause of animal heat is, it appears to me, about as inconsistent as to regard the contractile powers of the heart as derived exclusively from either the cerebro-spinal system, or from the influence of respiration, or from the contact of the blood with the interior of the parietes of the heart itself.

If the respiration be impeded, both a diminution of animal heat and a cessation of the heart's action will take place; but such phenomena must be attributed only to the circulation of diseased blood, which has the effect of directly paralyzing the nerves of organic life; from whence the vital energy of every single part of our organism is, I believe, exclusively derived.

If, then, the animal heat be *not* the product of any chemical change taking place, either in the lungs or in the secerning vessels—if it be not the result of the different capacities for *caloric* of the several fluid secretions of the body, and their source, viz., the blood—if it do not depend “on the moistening of the organic structures by their several fluids,” nor on the influence of the cerebro-spinal system—from what source, I would ask, can the animal heat be derived, but from the *ganglionic nervous system*?¹ That

¹ The remarks of Dr. Carpenter, at p. 847 of his ‘Principles of Physiology,’ are replete with interest. To my mind they add much weight to my own views as given in the text. “Among the lower tribes of animals, in which the power of locomotion is but feeble, and the supply of the wants of the system not immediately dependent upon it, very little more heat is generated than in plants. But wherever a high degree of muscular energy is required, in connection with a general activity of the functions of the nervous system, the evolution of caloric to a remarkable extent is provided for *in the nutritive processes*. We may regard it, therefore, as in its degree essentially connected with the development of the animal powers relatively *to the system of organic life*; although really *dependent*, as it would appear, upon the changes occurring in the latter. It is worthy of notice that, although the temperature of the various parts of the animal body is usually much more uniform than that of the different organs in vegetables (owing to the comparative rapidity with which the general circulation of the former diffuses the heat evolved in any one part, and thus tends to equalise the whole), wherever processes are going on which call the nutritive functions into extraordinary activity, *there* a corresponding elevation of temperature occurs. Thus, a slightly increased evolution of heat from the stomach has been observed during the determination of blood to its capillaries, which takes place during digestion; the same is observable in the reproductive organs

this is the fact is proved by the simple circumstance that the presence or otherwise of the brain and spinal cord in the foetus affects not the *animal heat* : *the acephalous monstrosity maintains its temperature so long as it may live, and so does the decapitated animal, in which also the spinal cord is destroyed.* We know, of a surety, that in all such cases the solar ganglion, or the ganglia of the great sympathetic, is (or are) still of those animals, in which the aptitude for the function is periodic only ; and the temperature of a muscle rises a degree or more during its contraction."

* * * * *

Again, at p. 855 : "Notwithstanding, however, that the chemical theory of animal heat may be considered as accounting for the ordinary maintenance of a fixed temperature in the body at large, yet there are some residual phenomena to which it scarcely appears applicable. Of this kind are the sudden elevation of temperature that occurs under the influence of nervous excitement, which may be either general or local ; the equally sudden diminution which marks the influence of the depressing passions ; and the rapid cooling of bodies in which the nervous centres have been destroyed, notwithstanding that the respiration is artificially maintained, and the circulation continues."

Some two years since, a paper was read at the Medical Society of London, by Dr. Winn, in which it was argued that *animal heat* is the direct consequence of the incessant contractions and dilatations of the arteries during life. The following experiment was performed by Dr. Winn, viz. : "Having cut off a circular portion of the descending arch of the aorta, about an inch in length, I laid it open, and carefully dissected out the elastic coat, and taking hold of it by each extremity, I pulled it to and fro with a continuous jerking motion (in imitation of the systole and diastole of the artery), for the space of about a minute, when, placing it upon the bulb of a thermometer, I had the satisfaction to find that after it had remained two minutes the mercury had risen as many degrees. On removing the thermometer the heat immediately began to diminish." Every precaution seems to have been taken by Dr. Winn, in the performance of the above experiment. He adds, "I think I am entitled to conclude that the whole of the heat developed in the animal economy can now be satisfactorily explained." The fact given by Dr. Winn is an exceedingly interesting one—however, I cannot doubt that the *animal heat* is primarily a *vital* rather than a *physical* phenomenon. Truly the *systole* and *diastole* of the arteries throughout the body may be attended with the elimination of *heat* ; but have we not still to look elsewhere and further for its original source ? Dr. Winn's very interesting paper is published in the 'Philosophical Magazine' for 1839.

in the exercise of its (or their) normal functions ; and we may know, too, if we will be at the trouble to investigate this question, that if, from any cause, the normal function of this (or these) same important centre (or centres) be interfered with, or interrupted in any way, the *animal heat* will directly fail. The legitimate and only conclusion, then, from all the foregoing data would seem to be, that the *animal heat* is a function of the *ganglionic system of nerves*.

One word more. I have somewhere read that the large intestines retain their temperature and vitality, in cases of suspended animation from hanging, or drowning, or hæmorrhage, and so on, very much longer than even the brain ; and this is, of course, what may be expected, and what should be.

The phenomena of INSTINCT are among the most interesting and curious appertaining to animal life. Like the "mind," instinct has been, and still continues to be, treated of as an abstract quality, and as one altogether independent of the organism. Lord Brougham, Müller, and Cuvier, if I mistake not, have so superficially written on this important physiological topic. There are various facts calculated to induce us to associate animal *instinct* with the ganglionic nerve-matter. It has been already shown that certain portions of the sympathetic nerve are first formed in the foetus—that the foetus itself, during the earliest period of its existence, assumes a character which, though only fleeting and temporary, belongs as a permanency to the lowest form of animal existence ; and it is well known that even in the Beroë and Actiniæ are manifested tendencies of a purely instinctive character. In cases of monstrosity where infants are born without either a brain or a spinal cord, it is a fact well insisted on, that instinctive movements exist, and are well and beautifully demonstrated ; and under circumstances of long-standing disease, wherein the cerebro-spinal system has become disorganized, and its functions therefore depraved and

obliterated (paralysed), it is well known that patients will give indications of a clear and palpable instinctive power. Moreover, in acute diseases, as fever, erysipelas, enteritis, and delirium tremens, including severe and dangerous bodily injuries, &c., wherein a fatal termination is apprehended, and wherein the cerebral and spinal functions are all but suspended—there, in such cases, it is by no means unusual to mark the persistence of certain instinctive acts, and especially as regards the position of the patient, and the preference shown for certain kinds of food or drink, and not less the rejection of many more. In old persons, when the powers of life are fast fading away—when the mind (brain) is losing its characteristics, and receding from its long-enjoyed attributes of reason and conscience; *i. e.*, when the spiritual (so called) and the corporeal are parting company for ever—then may we detect the re-assumption of those instinctive tendencies which characterised the early and infantine existence. Moreover, one cannot well fail to remark how the ordinary vital or organic functions and the instinctive habits of both animals and man go hand in hand, so to speak. Secretion and nutrition, like instinct, seem not unlike parts of one whole; and dependent equally on a first cause—a formative principle, if you will. In spite of certain seeming exceptions to this rule which will occur to the reader, we cannot but notice the active vitality of early childhood, *and* the very palpable *instinct* which guides its movements and presides over many of its habits; and although instinct, regarded as a vital act, is among the first to make its appearance; and although it would seem to retire, for a time and under certain circumstances, and so to make way, as it were, for the cerebral or psychical properties of both animals and man—yet is it observed to be the last which remains to the organism, and to cease altogether only when the aforesaid vital acts, as secretion, &c., shall have failed their wondrous offices in them

and us. Let us see on what grounds and on what reasoning the above position can be made good.

“In tracing the progressive complication of psychical manifestations,” writes Dr. Carpenter, “during the early life of the human being, a remarkable correspondence may be observed with that gradual increase in mental endowments which is to be remarked in ascending the animal scale. The first movements of an infant are evidently of a purely automatic character, and are directed solely to the supply of its physical wants: they are thus analogous to the instinctive actions of the lowest animals possessed of a nervous system. The new sensations which are constantly being excited by surrounding objects, call into exercise the dormant powers of the mind; notions are acquired of the character and position of external objects; and the simple processes of association, with its concomitant, memory, are actively engaged during the first months of an infant’s life. At the same time an attachment to persons and places begins to manifest itself. All these are the characteristics of the great majority of the lower Vertebrata, so far, at least, as our knowledge of their springs of action enables us to form a judgment. As the child advances in age, the powers of observation are strengthened; the perceptions become more complete; those powers of perception are called out which prompt him to reason upon the causes of what he observes, and to perform actions resulting from more complicated mental processes than those which guide the infant; and, at the same time, we observe the development of the moral feelings, which are at first manifested only towards beings who are the objects of sense. Among the more sagacious quadrupeds, it is easy to discover instances of reasoning as close and prolonged as that which usually takes place in early childhood; and the attachment of the dog to man is evidently influenced by moral feelings, of which the latter is the object. “Man,” it was expressively

observed by Burns, "is the god of the dog." Up to this point, then, we observe nothing peculiar in the character of man; and it is only when his higher intellectual and moral endowments begin to manifest themselves, especially those relating to an invisible Being, that we can point to any obvious distinction between the immortal $\psi\upsilon\chi\eta$, and the transitory $\pi\nu\epsilon\upsilon\mu\alpha$ of the brutes which perish."

* * * * *

"Ascending from the *articulated* through the *vertebrated* series, we observe a gradually increasing development of the reasoning powers, or intelligence; and a gradual fading away of the instincts, which become subordinate to the higher psychical faculties. A comparison between the habits of birds and those of insects will put this in a striking light. It has been shown that several points of correspondence exist between these two classes, indicating that they hold a corresponding rank in their several sub-kingdoms. But whilst all the actions of insects appear to be under the guidance of pure, unvarying instinct, those of birds, whilst evidently prompted by similar impulses, are yet capable of great modification in each individual (according to the peculiar circumstances in which it may happen to be placed), by the influence of its reasoning faculties. Ascending to man, we find the pure instincts so completely subordinated to the higher psychical faculties, that it is only when the latter are yet dormant, as in infancy, or undeveloped, as in complete idiocy, that their uncontrolled operation is witnessed. It is easy to perceive the final cause for this change. If the organization of the human system had been adapted to perform all the actions necessary for the continued maintenance of its existence, with the same certainty and freedom from voluntary effort as we perceive when pure *instinct* is the governing principle, and if all his sensations had given rise to intuitive perceptions, instead of those perceptions being acquired by the exercise of

his mind—it is evident that external circumstances would have created no stimulus to the improvement of his intellectual powers, and that the strength of his instinctive propensities would have diminished the freedom of his moral agency. Although, therefore, to all the actions *immediately* necessary for the maintenance of his own existence, and for the continuance of his race, a powerful instinct strongly impels him, these propensities could not be gratified, if the means were not provided by the exercise of the mental powers, which he enjoys in a degree far exceeding those of any other terrestrial being. Hence we should be led to regard his place in the animal kingdom, as being not at its head or in its centre, but at the extreme most remote from its point of contact with the kingdom of *organic life*; in fact, at the point at which we may believe it to touch another kingdom, viz., that of *pure intelligence*."

The preceding remarks I conceive to be of much value and importance, inasmuch as they so evidently point to the ganglionic nervous system as the seat of INSTINCT. It should be remembered, that not only are the first movements of the infant—*i.e.*, in its normal state of being—"of a purely automatic character," and "analogous to the instinctive actions of the lowest animals," but that those also of the monster born without either a brain or spinal cord, and with only ganglionic nerve-matter, are of precisely the same kind, and *in every respect analogous to the instinctive actions of the common worm or spider, &c.*: and, moreover, that in many cases of congenital idiocy, where both the brain and spinal cord are physically incompetent to the exercise of anything like their commonest offices in the animal economy, the very same facts obtain.

The presence of instinct is, it appears to me, an indication of the activity of the organic functions—*instinct* is one of these; it is always seen in combination with them; it partakes of their activity or otherwise. Instinct is ever mani-

fested in proportion to the development of the organic nervous system; and, inversely, to that of the cerebro-spinal system. It is the substitute for intelligence, for reason. Instinct is to the wasp or beaver what experience (reason) is to man. Instinct prompts the idiot to the same automatic movements which are directed to the supply of its physical wants, as experience and reason may and do a healthy and sane man to eat, or sleep, or walk, and so on.

Up to the present time considerable difficulty has been manifested in preserving the line of demarcation between *instinct* and *reason* (volition),¹ or rather between the instinctive

¹ Dr. Roget regards the manner in which the Infusoria and Actiniæ pursue their prey, and their selection of it, and the facility with which they recede from whatever may prove hurtful to them, &c., &c., as evidence not only of the highly sensitive and irritable nature of the organism of the Medusariæ generally, but of the presence of a positive *volition*, i. e., "voluntary action." He writes thus in the chapter "On the Comparative Physiology of the Nervous System," p. 538: "But whatever may be their extent, it is probable that the *sensorial operations* of the zoophytes take place without the intervention of any common centre of action"—meaning thereby that their *volition* exists independently of a brain. Upon reconsideration, and at this time, Dr. Roget may be disposed to alter his views. However, it would seem more likely that the actions or habits of the said Infusoria and Actiniæ are really *instinctive*, than that the same should be dissociated with, or independent of, any *nervous centre*; and withal *volitional*. The fact is, these little animals, one and all, pursue their prey, select it, and escape any threatened danger, &c., from the first to the last moment of their existence in virtue of an instinctive and preservative tendency belonging to their organism; after much the same fashion that the sensitive plant expands to the genial warmth of the sun-rays, or contracts on the approach or contact of whatever may prove hurtful to its delicate structure, or that the "Venus's trap" closes its petals and shuts within its fatal embrace the truant fly, or other insect, which would deprive the flower of its sweetness and purity. To extend the illustration—the sudden and peculiar shrinking of the *hydra* when under the influence of fear, and the extreme caution and dexterity displayed by the infusory animalculæ in avoiding obstacles of any kind while swimming together in myriads in a single drop, are *instinctive* vital actions, arising from an inherent preservative principle derived from the organic nervous system, and similar in its nature to that which induces even us, in the *moment* of danger and doubt, to place our

and cerebral faculties; and to this circumstance must be attributed, in a very great measure, the violent opposition

extended palm across the præcordia. Thus the affected miss, though ignorant of physiology or pathology, and perhaps of all other *ologies*, if either alarmed, or professing to be so, at any sufficient or insufficient cause of personal danger, quickly applies her hand to the præcordia; as if the solar plexus screamed "*take care of me now.*" What more reasonable than to expect that that organ, the sum of whose function may be in one word described as *life*, should preside over actions of the kind mentioned above, so *indispensable as they are to both its integrity and well-being!*

Referring to the words of the *text*, I would add that the "difficulty in preserving the line of demarcation" between the *cerebral* and *ganglionic* functions—that is, between the *reason* and *instinct*,—will be very materially diminished if we would bear in mind the following remarks from the pen of the late Dr. Fletcher: "All those actions in short which commonly originate in deliberate design, which are at first generally more or less incompetent to effect the desired end, and which become only progressively perfect, are with propriety referred to this head, since these, as already stated, are the characteristics of a rational, as distinguished from an instinctive action. Many of these actions, however, become, even in man, occasionally instinctive, as in the case of enthusiasts, or persons under extremely strong excitement, or those in whom the influence of reason has been diminished by a certain degree of fatuity or furiosity, provided always such persons have previously possessed reason sufficient to bring these actions to perfection. And indeed all these actions become by habit in a certain sense instinctive, the instinct perpetuating the successive improvements which volition has made, till at length volition only determines the performance of these actions on any given occasion, and sets the requisite muscles in motion, while it is instinct which enables them to act with ease and accuracy. But, in the lower animals, a great number of these actions appear to be always and from the first instinctive. Thus the process of hoarding up grain by the ant, and honey by the bee, that of depositing their ova by many of these animals in appropriate places, that of migrating by several gregarious tribes, and that of constructing its shell by the snail, its web by the spider, its cocoon by the silkworm, its comb by the bee, its nest by the bird, and its hut by the beaver—all involve many of the actions above enumerated, but the stimulus by which they are excited is apparently, not *volition* but *instinct*; and such actions are accordingly undertaken by them without any deliberation, conduce in the most effectual manner to the end in view, and are as perfectly performed the first time they are undertaken, as at any subsequent period. It would be nevertheless as great a mistake to believe that *all* the actions of the lower animals are instinctive, as to imagine that all those of man are rational. The ant hoards its

which has been persisted in to phrenology. Thus Dr. Prichard writes in the Appendix to his work on 'Insanity,'

grain as actuated by instinct; but it is as actuated by reason that it bites off the the germinating part of it, if such grain have ever sprouted on its hands. It is from instinct that the spider constructs its web; but it is from reason that it chooses its time for pouncing on the prey which this web has entangled, and refrains from doing so whenever it perceives at hand an enemy to be dreaded. It is instinct which prompts the bird to build her nest; but it is reason which instructs her to choose a more secure place for doing so, if she ever have had her eggs stolen. All the former actions are impetuous, immutable and perfect from the first—all the latter are deliberate, adapted to the occasion, and improvable by practice. It requires no experience to excel in instinctive actions; but it is experience alone which renders a cat wary and successful in secreting her kittens, or a hare or deer in eluding the arts of the huntsman; and the tricks of an old fox, both in attaining his prey, and in avoiding the snares spread for him, are so remarkable, that the term has become emblematical of a cunning fellow. Any animal which is educatable—if the expression may be allowed—is in the same degree rational; and that many of the actions of the lower animals are improvable by education, natural or artificial, is as certain as that many of those of man are not so. The actions of both have obviously a double origin; and the only difference between the two appears to be that, while the greater number of the actions of man spring in general from reason, and comparatively few from instinct, in the inferior tribes of animals the majority are instinctive, and few only in comparison are rational. Hence, while some of the analogous actions of both are excited in both by instinct, and others in both by reasons, there are not a few of these analogous actions, which have in man, as elsewhere observed, a very different origin from what they have in brutes. The fabric which man brings to comparative perfection only after long reflection and repeated failures, and profiting, not only by his own experience, but by that of the myriads who have gone before him, the worm, the insect, the bird, or the quadruped undertakes without deliberation, and brings to perfection, not only in its own generation, but the first time it is attempted."

The two annexed anecdotes are to the point, and are not unlikely to fasten the principle for which I am contending on the mind of the reader :

Dr. Darwin tells us, that "a wasp on a gravel walk had caught a fly nearly as large as itself. Kneeling upon the ground I observed him separate the tail and head from the body part, to which the wings were attached. He then took the body part in his paws, and rose about two feet from the ground with it; but a gentle breeze wafting the wings of the fly, turned him round in the air, and he settled again with his prey on the gravel. I then distinctly observed him cut

p. 473, "Now, if it should be established that all those properties of animal life, approximating to intelligence, or bearing analogies so striking to the manifestations of mind which, in one great division of the animal kingdom, are assumed to be essentially connected with, and depending upon, a particular system of organization, exist in another department, and display themselves in all the same various profusion, while the creatures belonging to this latter department are yet destitute of that system of organization, and of anything that bears resemblance to it, the advocates of phrenology will be obliged to abandon that broad ground on which they have attempted to fortify their position."

The above few words are intended by their author to apply to the lowest classes of animals exclusively, and not to include the vertebrated tribes. In reference to which, however, he adds, that although "the general analogy which prevails

off with his mouth, first one of the wings, and then the other, after which he flew away with it unmolested by the wind." Now, I take it that the mere pursuit and selection of the fly by the wasp as its prey was an act purely *instinctive*, whilst the clipping off of the wings under the circumstance narrated shows *it* to have been cerebral.

A newspaper paragraph contained the following statement as to facts, viz., A couple of martins having built themselves a nest about some stone-work of a gentleman's lodge, were forcibly dispossessed of the same by a pair of very combative sparrows, which entertained rather equivocal notions of *meum* and *teum*. The martins finding themselves without a chance of recovering their stolen habitation (nest), determined on a very novel, yet ingenious, method of retaliation—one which completely verified the old adage, that *the battle is not always to the strong*: they watched their opportunity, it is said, and shaking off their slumbers at an unusually early hour of the morning—found, as they had good reason to suspect, that their unprincipled neighbours had not yet vacated the said nest, or dormitory—and proceeded forthwith, and in right good earnest, to close up the hole which had access to its interior. The martins, we are assured, proved themselves such admirable masons in this particular instance—that the sparrows were literally buried alive. Now the original construction of the nest was instinctive or ganglionic, but the subsequent act certainly cerebral; whilst both were perhaps of a decidedly "intellectual character."

throughout these tribes in the organization of their cerebral and nervous systems affords no room for so *decisive* a contradiction to the relation which the phrenologists would establish, yet, even within this field, great and striking facts display themselves, which are adverse to the hypothesis. Birds and reptiles, as Jacobi has observed, are nearly, if not wholly, destitute of many cerebral parts, which, in mammals, are held as of high importance for the manifestation of psychical properties, and yet they display psychical phenomena similar to those of mammals. Wherever an undoubted and tangible fact can be laid hold of in the different proportional development of cerebral parts, which can be brought into comparison with the relative differences of animal instinct, or of physical properties in general, there is, if I am not mistaken, a manifest failure of correspondence between the two series of observations. This has been shown by Rudolphi, in a striking manner, with respect to the cerebellum. The cerebellum, as this writer has observed, is found to lessen its proportional development as we descend in the scale of organized beings, without any corresponding diminution, and even with increase, of the propensity which Gall connects with it. How remarkably powerful is this instinct in birds, and yet how small is the cerebellum in the feathered tribes compared with its size in mammals; and even in the latter, when we consider the magnitude which it attains in the human species."

Before proceeding further, it must be well remembered that *instinct* is nothing more nor less than an animal function, and that, therefore, like any other function of the body, it must be considered in connection with the organic structure exercising it.

A modern writer has these words: "By many we fear that the term *instinct* is used in relation to brutes, in the same way that the term *mind* is used in relation to man,—as a certain power superadded to matter, and causing it to mani-

fest certain phenomena. As in man, it has hitherto been considered necessary to enlist an essence to explain phenomena, which remain after the intended explanation just as mysterious, so in the inferior tribes, the term *instinct* has been presumed to solve all difficulties. The distinctive characteristics of each tribe, as regards cerebral manifestations, have been duly recorded, and this indefinable, because unascertainable, power has been considered the cause. That we are correct in this statement, we might quote a variety of passages from several recent writers, but the following clear and explicit recognition of the doctrine from the pen of Lord Brougham will suit our purpose: 'Instinct is one and indivisible, whatever we may hold it to be in its nature, or from whatever origin we may derive it. The thing or being is variously applied, and operates variously. There are not different instincts, as of building; of collecting food for future wants; of emigrating to better climates; but one instinct which is variously employed or directed.' The peculiar powers put forth by an animal are the necessary result of its peculiar formation; and to assert that instinct prompts to the performance of a certain action seems to us an attempt to intrude a power which we cannot recognise, of the existence of which we have no proof, and the intrusion of which into scientific discussion is opposed to all sound philosophy. Instinct is not a power producing certain phenomena, but instinctive actions are the result of the activity of a peculiar nervous organism. We cannot tell *why* such a form of matter manifests such peculiar functions: it is quite sufficient for us to ascertain that it does so: beyond this we might never go."

I have said that up to the present time considerable difficulty has been manifested in preserving the line of demarcation between instinct and reason; or rather between the instinctive and cerebral functions of man and the lower

classes of animals. Now it has been asked by Dr. Prichard, just now quoted, " Shall we say, after tracing the operations of a constructive instinct so wonderfully displayed by the beaver, or in the cells in which the bee lays up its honey, that an impulse to action precisely similar gave origin to the Pyramids of Egypt or to the building of Constantinople? Shall we venture to affirm that the tunnel under the Thames owes its existence to a burrowing propensity resembling that of the rabbit or the mole? Shall we conclude that Parry and Franklin sought the regions of the North impelled by the instinct of the migratory rat, and that Magellan and De Gama traversed the Southern Ocean directed by an influence analogous to that which moves the flight of swallows? Or, may we, with greater probability, determine that the lower tribes act under the guidance, not of blind instinct, but of enlightened reason,—that metaphysicians were mistaken when they laid down the principle, '*Deus est anima brutorum*'—that the birds of passage have some acquaintance with physical geography, and know the quarters where tropical warmth exists, and genial breezes blow; that the bee has studied the exact sciences, and knows by calculation the form most advisable for its cells?—in short, that there is a real analogy and correspondence between the mental faculties of man and the psychical endowments of those creatures whom he conceitedly regards as his inferiors? If either of these positions can be maintained, there will be a sound foundation for the comparative psychology of Dr. Gall and his followers; but if they should be rejected as improbable, we must admit that the analogies pointed out are remote, the things compared are different in kind; they agree only in outward appearances; and we shall be brought to the conclusion that it has pleased the Author of nature to bring about corresponding results, in the rational and irrational departments of the creation, by very dissimilar means."

It will require perhaps no very great effort of the brain of a tolerably organized man to perceive that the "constructive instinct" of the beaver and the bee must be a very "dissimilar" faculty to that which, in old Cheops and Constantine, directed either the elevation of the Pyramids or the building of an Eastern city. Granting, for the sake of the argument, that the Egyptian and Roman kings here named were the architects of the above objects of interest, how few are there who will venture to assert that these men never improved their architectural skill by thought and experience. Dare any one be so bold as to declare that the first effort of either of them was equally successful as the last? Can it be supposed that their ingenuity cost them no trouble, no effort; that the several plans they devised, and arrangements they perfected, were found to be equally plain and easy, and not less natural than they experienced the act of *lactation*? Among the lowest classes of animals, and, of course, in the instances of the beaver and the bee, the last effort is no more successful than the first. Experience with them is not instruction. They begin as they proceed and end, and the ending of their labours—their hour-glass of existence having run through—is precisely similar to the beginning. They have never to regret incorrect data nor fallacious deduction; or to lament over a miscalculation, and promise themselves a better fortune for the future. The instinct of the beaver and the bee is *perfection*, not so the constructive faculty of man. The first is a ganglionic function, the second a cerebral; the one is inherent and active, the other inherent and passive only. Instinct, no less than secretion and absorption, is perfect from the first.

The functions of the ganglionic system arise spontaneously, but those of the brain, *i. e.*, the intellectual faculties, require more or less direction and cultivation. "An instinctive action is an action performed by a being, resulting neither

from observation nor experience—perfect from the first, as regards the means used and the end to be obtained—always the same in all healthy animals of the same species, and the necessary result of a peculiar organism.”—“A rational action is an action performed by a being, resulting from observation and experience; and, therefore, capable of being improved—seldom precisely the same in any two animals of the same species, but, nevertheless, the necessary result of the degree of development and exercise of a peculiar organism.” Upon these premises, then, it is plainly perceived, first, that the impulse to action in the beaver and the bee is NOT precisely similar to that which gave origin to the Pyramids of Egypt or to the building of Constantinople; secondly, that the things compared *are* different in kind, and agree only in outward appearances; and thirdly, that it *has* pleased the Author of nature to bring about corresponding results in the rational and irrational departments of the creation, by very dissimilar means: and that, therefore, it is established, and very plainly too, that all those properties of animal life, approximating to intelligence, or bearing analogies so striking to the manifestations of mind, which, in one great division of the animal kingdom, are assumed to be essentially connected with, and depending upon, a particular system of organization, *do* exist in another department, and display themselves in all the same various profusion, while the creatures belonging to this latter department *are* yet destitute of that system of organization—but it by no means follows, as Dr. Prichard erroneously assumes, that because such is the case, the advocates of phrenology are obliged to abandon their strong ground of belief.

What else than a mere *similitude* to a *rational* act can be discovered in the kid which Galen took from its mother's womb, and which, of course, had never sucked, when, upon many shallow pans with different liquids being placed near it, the animal pre-

ferred at once the pan containing goat's milk ; or, in that of the young alligator, which, on being liberated by Dr. J. Davy from its shell, immediately made its way towards the river ; and, on being pointed at with a stick, " put itself in a posture of defence, as an adult alligator would have done in like circumstances."

The following fact, witnessed by Sir James Hall, and mentioned by Sir George Mackenzie in the ' Phrenological Essays,' is one of pure *instinct*, unmixed with anything like reason ; which presupposes experience and reflection. " Sir James Hall had been engaged in making experiments on hatching eggs by means of artificial heat ; and, on one occasion, observed in one of his boxes a chicken in the act of breaking from its confinement. It happened that, just as the creature got out of the shell, a spider began to run along the box, when the chicken darted forward, seized and swallowed it." On this case, Dr. Elliotson¹ has remarked, " It was not merely the eye that was perfect, but the innate powers of knowing instantaneously what was proper for it as food, of judging of distance, and of putting its limbs into action."

Regardless of the wonderful perfectibility of all instinctive faculties from the first moment of existence, some may, perhaps, feel disposed to doubt the *possibility* of instinct being associated, in any way, among insects, with the cerebral conformation ; seeing that one can hardly detect anything more than a medulla oblongata, into which the nerves supplying the external senses are inserted : but any position based on so frail a tenure I should always be strongly disposed to discredit. The organism of the insectora, in common with that of other animals low down in the scale of being, displays, as is well known, so wonderful and concentrated an energy. Look to the extraordinary strength of the flea, beetle, and grasshopper, for instance ; how exqui-

¹ See Elliotson's ' Human Physiology.'

sitely developed must be their motive powers; how seemingly incompatible is the muscular power of these little creatures with their size and form. There can be no *reason* why this same fact should *not* obtain in reference to a cerebral, as well as to a spinal and muscular organism. Haller tells us that "a flea can draw from seventy to eighty times its own weight, whereas a horse cannot draw with ease more than three times its own weight."

It cannot be too well known that there is such a thing as *quality*, as well as *quantity*.¹ It was the inattention

¹ Turner in his 'Sacred History of the World,' advocates the same erroneous views of this question, as do Prichard and Roget. He, like them, treats of the *instinctive functions* as something very identical with the *mental phenomena*, and he also refuses to recognise the brain as the organ of the mind—because the intellectual qualifications of the *ant* are not only so much like those of man, but, what is more, are associated (in the former) "with one of the smallest species of a visible body," or, what is the same thing, with too minute a cerebrum to allow of the exercise of that power so vigorously maintained. However, whilst he takes so much care to render the *mind* independent of matter, and refuses to the diminutive cerebrum of the insect the *possibility* of its having anything to do in the animal economy, Mr. Turner very liberally provides for the spinal nerves. He tells us that Linnæus remarks, that if an elephant were as strong in proportion to a stag-beetle, he would be able to tear up rocks and to level mountains. A cockchafer is, for its size, six times as strong as a horse (Kirby). The flea and locust jump 200 times their own length; as if a man should leap three times as high as St. Paul's. The cuckoo-spit frog-hopper will sometimes leap two or three yards, which is more than 250 times its own length; as if a man should vault at once a quarter of a mile. Mouffet relates that an English mechanic, named Brack, made a golden chain as long as a finger, with a lock and key, which was dragged by a flea. Latrielle mentions a flea, of a moderate size, dragging a silver cannon on wheels, that was twenty-four times its own weight, which being charged with powder was fired without the flea seeming alarmed. Apropos, the physiological principle involved in the preceding observations is well illustrated in the eloquent apology offered by the famous Sir Geoffrey Hudson, who was remarkable not less for his diminutive stature than for the conspicuous part he played during the reign of the two Charleses. Sir Walter Scott, in his 'Peveril of the Peak,' makes Hudson thus address Julian: "It is strange now that you overgrown men never possess the extreme firmness of nerves proper to us who are cast in a more compact mould. My own voice

of the late Dr. Prichard to this anatomical axiom, which prevented him detecting the erroneous conclusions of Rudolphi, with respect to the cerebellum of birds, considered in connection with their amatory propensities. If the position herein taken were untrue, we should not see those animals which are without every vestige of not only a brain, but a spinal cord, performing instinctive functions, of the same startling character as those of the beaver and bee, &c. We should in fact fail to detect the peculiar shrinking of the hydra when alarmed, as well as the resources, under difficulty and danger, of many of the Actiniæ and Acephalæ.¹

The observations of Müller on INSTINCT support the view here taken, viz., that instinct is the function of the organic nervous system, as digestion is that of the stomach, &c. He says, in his work on 'Physiology,' p. 946, &c. :

retains its masculine sounds on all occasions. Dr. Cockerell was of opinion, that there was the same allowance of nerve and sinew to men of every size, and that nature spun the stock out thinner or stronger, according to the extent of surface which they were to cover. *Hence, the least creatures are oftentimes the strongest.* Place a beetle under a small candlestick, and the insect will move it by its efforts to get out ; which is, in point of comparative strength, as if one of us should shake his Majesty's prison of Newgate by similar struggles. Cats also, and weasels, are creatures of greater exertion and endurance than dogs or sheep. And, in general, you may remark that little men dance better, and are more unwearied under exertion of every kind, than those to whom their own weight must necessarily be burdensome. I respect you, Master Peveril, because I am told you have killed one of those gigantic fellows who go about swaggering as if their *souls* were taller than ours, because their *noses* are nearer to the clouds by a cubit or two. But do not value yourself on this, as anything very unusual. I would have you to know it has always been thus ; and that, in the history of all ages, the clean, tight, dapper little fellow, hath proved an overmatch for his bulky antagonist." * * * * "In the classics, also, you have Tydeus, and other tight, compact heroes, whose diminutive bodies were the abode of large minds," &c. Charles the Second is said once to have remarked of Hudson, that "fortune, to make him the model of absurdity, has closed a most lofty soul within that little miserable carcass."

¹ See Roget's 'Bridgewater Treatise,' vol. i.

“The cause of instinct appears to be the same power as that on which the first production of the animal, and the perfection of its organization in unison with an eternal law, depend. The instinctive acts of animals show us that this power, which, independent of any organs(?), forms the whole organization with reference to a determinate purpose, and in accordance with an unchanging law, *has, moreover, an action beyond this*. That which is effected by the instinctive movements is equally in accordance with a determinate purpose, and as necessary for the existence of the germs and species as the organization itself; but while, in the case of the organization of the being, the object attained formed part of the organism, in the case of the instinctive movement it is something in the exterior world. The primary cause of instinct is, therefore, not seated in any one organ, but is identical with *the creative force of the organization*; the operations of which are judged by an unvarying law.” Because Cuvier has said that animals in their acts of instinct are impelled, as it were, by an innate idea—a dream; Müller seems strongly disposed to drag the “sensorium” in to explain the difficulties of the question; but he correctly adds, “Both the internal impulse and the external organization being dependent on *the same original cause*, the form of the animal appears in complete unison with its impulses to action; it wills to do nothing which its organs do not enable it to effect, and its organs are not such as to prompt to any act to which it is not impelled by an instinct.”

It is perceived that Müller has here fallen into the common error of physiologists, in treating of *instinct* as the cause, and not as the effect; just as the metaphysicians have done when speaking of the mind.

In order that the reader may be fully aware of Müller's idea on this subject (instinct), I insert here the following quotation from his ‘Elements of Physiology:’ “There is one

class of phenomena in which the creative vital power of the animal organism takes a part in the operations of the mind, directing them, producing series of thoughts like dreams, and determining the animal to certain acts which are called instinctive. The bee is obliged to realise the cells of wax according to the type presented as a dream to its sensorium; each animal of a species must construct its habitation or its web on the same plan as those which have preceded it, or must sing as they have done; perform the same migrations, and protect its offspring while under the rule of passions which take their rise in the business of generation. The originator of all these ideas is the organizing force—the first cause of the organism, which reproduces like from like, and forms all the organs of the animal body in accordance with design. It is this power which determines animals to the act of sexual union; which enables the young to maintain their equilibrium without previous education; and leads the ducklings to seek the water, the mole the burrow, and the sloth to climb, in accordance with the structure of its limbs, which are adapted for that movement, and not for leaping. In these phenomena we see a power at work which has the attributes of the unconscious vital principle, and not those of the mind: but this power merely gives the theme of the instincts; their realisation is effected by an act of the mind itself. The cells of the bee, and the electric organs of certain of the lower animals, owe their origin primarily to the same cause; but the immediate agents engaged in their construction are different; the mind coming into play in the case of the bees, and acting as the mediate agent in the realisation of that structure out of the body of the animal, which the vital force within it has determined.”

That the instinctive faculties of the lower animals admit of some *modification* by circumstances, I think there cannot be much doubt:—thus, in Ceylon it is the practice never

to allow ducks and turkeys to hatch their own young; this duty is made to devolve on the hen; and, in consequence of this plan having been adopted through so many successive generations of ducks and turkeys, it is *now* a very rare thing for these birds to give any indications of the "storge" so called. The following passage occurs at page 69, vol. i, of 'The Crescent and the Cross,' a highly interesting work of travels, by Warburton Elliot, Esq.: "One of the sights which amused me most was a chicken-hatching oven. This useful establishment is at some distance from the Walls, and gives life to some millions of chickens annually. It seems that the hens of Egypt are not given to sedentary occupations; having been hatched themselves by machinery, they do not feel called upon to hatch; they seem to consider that they have discharged every duty to society in producing a mere egg; no domestic anxiety ruffles their bosoms; they care not whether their offspring becomes a fritter or a fowl, an omelette or a game cock. We entered their foundling hospital—a gloomy and filthy hut, in which a woman was squatting, with a dark, little, naked imp at her bosom; she sat sentry over a hole in the wall, and insisted clamorously on *backsheesh*; having satisfied her in this particular, we introduced ourselves with considerable difficulty into a narrow passage, on either side of which were three chambers, strewn with fine mould, and covered with eggs, among which a naked Egyptian walks delicately as Agag, whilst he turns them with most hen-like anxiety. The heat was about 100°, the smell like that of Harrowgate water, and the floor covered with egg-shells and struggling chicklings. The same heat is maintained day and night, and the same wretched hen-man passes his life in turning eggs; his fee is one half the receipts; he returns fifty chickens for every hundred eggs that he receives."

The influence exerted by circumstances on the instinct of

animals is, moreover, plainly demonstrated by the harmony and good will which prevail in the "happy family" of cats, rats, and birds, &c., to be seen in London and elsewhere.¹ In this case the first effect is no doubt cerebral, which must be propagated to the organic nervous system. If the faculty of instinct had no definite organ, unlike every other bodily function, we might then wonder at the influence of circumstances over it, but not otherwise.²

In considering the beneficent care taken of the lower animals by nature, and the advantages which their instinct provides them with, how much is the vanity of man humbled; how forcibly are we reminded of the eloquent yet satirical couplet of Pope, wherein he makes man exclaim—

" ' See all things for my use.' "

' See man for mine,' exclaims a pampered goose."

The annexed quotation from Dr. Roget ('Bridgewater Treatise'), will very appropriately conclude this chapter: "While nature has apparently frowned on the birth of

¹ How much is it to be regretted that an example so glorious as this one should be lost to the world. How many a would-be legislator is in the habit of passing and repassing this "happy family" on his way to and from the Houses of Parliament, whereat he may be heard denouncing the abettors of a rational system of education, anathematising the amelioration of our criminal code, and abusing the poorer and less fortunate classes of men for not resisting the influence of circumstances which they have not chosen; without once thinking that the operation of a similar principle of treatment is all that *man* requires to render him intelligent, virtuous, and happy. Shame! oh, shame!

² It is said on good authority, that if the eggs of some birds be removed from the nest so soon as laid, the hen will go on laying more, *within certain limits*, until the usual number be collected; and if so, does this not prove a certain dependency of the instinctive faculties on accidental or acquired circumstances; and, inasmuch as these can only take effect through the influence of the brain, it follows, not only that the mental powers may modify the instinctive, but what is more, that the latter, like the former, are susceptible of a certain training or education; and from all which it is to be concluded rightly—that both "instinct" and "mind" so called, are dependent alike for their integrity, or otherwise, on

man, and brought him into the world weak, naked, and defenceless, unprovided with the means of subsistence, and exposed on every side to destruction, she has in reality implanted in him the germ of future greatness. The helplessness of the infant calls forth the fostering care and tenderest affections of the mother, and lays the deep foundations of the social union. The latent energies of his mind and body are successively, though slowly developed. While the vital organs are actively engaged in the execution of their different offices, while the digestive apparatus is exercising its powerful chemistry, while myriads of minute arteries, veins, and absorbents are indefatigably at work, in building and modelling this complex frame, the sentient principle is no less assiduously and no less incessantly employed. From the earliest dawn of sensation it is ever busy in arranging, in combining, and in strengthening the impressions it receives. Wonderful as is the formation of the bodily fabric, and difficult as it is to collect its history, still more marvellous is the progressive construction of the human mind, and still more arduous the task of tracing the finer threads which connect the delicate web of its ideas, which fix its fleeting perceptions and which establish the vast system of its associations, and of following the long series of gradations by which its affections are expanded, purified, and exalted, and the soul prepared for its higher destination in a future stage of existence.

“ Here indeed we perceive a remarkable interruption to that regular gradation, which we have traced in all other parts of the animal series ; for between man and the most sagacious of the brutes there intervenes an immense chasm, of which certain portions of the animal organism. That the same faculty, feeling, or desire, may be regarded, at different times, and under opposite circumstances, as either ganglionic or cerebral—that is, either *instinctive* or *mental*—there can be little doubt : thus the love of offspring in mankind is principally cerebral, or, I conceive, it would not be continued as it is, but *cease* with lactation ; *as it does among the lower classes of animals.*

we can hardly estimate the magnitude. The functions which are purely vital, and are necessary for even the lowest degree of sensitive existence, are possessed equally by all animals; in the distribution of the faculties of mere sensation a greater inequality may be perceived; the intellectual faculties again are of a more refined and nobler character, and being less essential to animal life, are dealt out by nature with a sparing and partial hand. Between the two extremities of the scale we find an infinite number of intermediate degrees. The more exalted faculties are possessed exclusively by man, and constitute the source of the immense superiority he enjoys over the brute creation, which so frequently excels him in the perfection of subordinate powers. In strength and swiftness he is surpassed by many quadrupeds. In vain may he wish for the power of flight possessed by the numerous inhabitants of the air. He may envy that range of sight which enables the bird to discern from a height at which it is itself invisible to our eyes the minutest objects on the surface of the earth. He may regret the dulness of his own senses when he adverts to the exquisite scent of the hound, or the acute hearing of the bat. While the delicate perceptions of the lower animals teach them to seek the food which is salutary and avoid that which is injurious, man alone seems stinted in his powers of discrimination, and is compelled to gather instruction from a painful and hazardous experience. But if nature has created him thus apparently helpless, and denied him those *instincts* with which she has so liberally furnished the rest of her offspring, it was only to confer upon him gifts of infinitely higher value. While in acuteness of sense he is surpassed by inferior animals, in the powers of intellect he stands unrivalled. In the fidelity and tenacity with which impressions are retained in his memory, in the facility and strength with which they are associated, in grasp of comprehension, in extent of reasoning, in capacity of

progressive improvement, he leaves all other animals at an immeasurable distance behind. He alone enjoys in perfection the gift of utterance ; he alone is able to clothe his thought in words ; in him alone do we find implanted the desire of examining every department of nature, and the power of extending his views beyond the confines of this globe. On him alone have the high privileges been bestowed of recognising and of adoring the power, the wisdom, and the goodness of the Author of the universe, from whom his being has emanated, to whom he owes all the blessings which attend it, and by whom he has been taught to look forward to brighter skies and to purer and more exalted conditions of existence. Heir to this high destination, man discards all alliance with the beasts that perish ; confiding in the assurance that the dissolution of his earthly frame destroys not the germ of immortality which has been implanted within him, and by the development of which the great scheme of Providence here commenced will be carried on, in a future state of being, to its final and perfect consummation."

APPENDIX TO CHAPTER II.

Being a paper read at the Quarterly Meeting of the Bath and Bristol Branch of the British Medical Association, March 25, 1854, entitled—

“ON THE EXCITO-MOTORY OR DIASTALTIC NERVOUS SYSTEM
OF DR. M. HALL. BY J. G. DAVEY, M.D.

“In bringing the subject of Dr. M. Hall’s important discoveries to the attention of this meeting, I trust I may not incur the charge of anything like presumption or arrogance of opinion, seeing that it is not my intention, any more than it is my ability, to question either the accuracy of the experiments of Dr. M. Hall, or the importance of the great mass of facts mentioned by this eminent physiologist in his various writings on *the true spinal functions* ; nevertheless, I trust to be excused if I should offer, as I am about to do, for the consideration of my medical brethren, and even of Dr. M. Hall himself, certain reasons for believing that the excito-motory phenomena, as explained by him, rest on a basis which even *he* has up to this time failed to recognise.

“It is doubtless well known to those present that the one great and important feature, in the researches of Dr. M. Hall, is the complete independence and entirety of the true spinal or diastaltic nervous functions, considered in reference to the mere phenomena of *sensation* and *motion*, located respectively in the two roots of the spinal cord. It has occurred to me, on investigating certain facts in connection with the ganglionic nervous system, its physiology and pathology, that Dr. M. Hall would encumber his peculiar labours with certain details, not only *not* necessary, as he has

supposed them to be, to his argument and conclusions ; but what is more, subversive of the real merits of those great and withal highly successful labours with which his name will be for ever associated.

“The object, then, of this paper is to demonstrate that the excito-motory, diastaltic, or true spinal functions, so graphically described by Dr. M. Hall, not only stand in no need of the additional set of nervous fibres, viz., the ‘incident’ or excitor, and reflex or motor, which this gentleman has himself anticipated, and Mr. Grainger has made an attempt to realise with the aid of the scalpel ; but what is more, that the mere *sensory* and *motor* (spinal) nerves or roots are themselves sufficient, under the circumstances to be explained presently, to realise all those wonderful phenomena, physiological and pathological, with which Dr. M. Hall has made the profession so fully acquainted.

“In order to give this essay a really practical character, and with the view of rendering the same the more acceptable to him whose mind may require to be refreshed somewhat in so far as the nature and extent of Dr. M. Hall’s investigations are concerned, I would beg leave to preface my remarks with a slight sketch of the excito-motory system, so called. Moreover, my doing so will put me in a much better position to offer objections to a few of the same investigations, as well as to submit, for calm consideration, my own impressions as to the source and exercise of that power, on which the diastaltic or ‘true spinal’ functions depend for their integrity and continuance.

“When Mr. Walker, in the early part of the present century, announced his discovery, not of the double origin of the nerves proceeding from the spinal cord, nor of the *dual* function of the same—for these were facts known long anterior to this present century—but of the particular portions of the same organism which preside respectively over *sensation* and *motion*,

he could hardly have anticipated the great and important results which were so soon to succeed his own exertions in the cause of physiological science. To the more practical investigations of Sir Charles Bell we are indebted for a series of experiments which, whilst they realised to a very great extent the conclusions of Walker concerning the spinal functions, added so materially to all our former knowledge of the nervous system, its functions and derangements, and imparted so peculiar a charm to the subject of his inquiries, that the real discoverer, of the physiology of the medulla spinalis, is but partially known to the profession of which he was so bright an ornament.

"As above intimated, the peculiar characteristic of Dr. M. Hall's views, as compared with those demonstrated by Walker and Bell, is *the distinction made between excited and voluntary motion*. It is quite necessary that this *fact* should be distinctly borne in mind, so indispensable is it to the right comprehension of what is to follow in the course of this paper.

" 'The true spinal marrow,' says Dr. M. Hall, 'may be correctly viewed as a distinct *organ*, totally different in its properties and functions from the cerebrum,¹ and as the centre

¹ "Each nerve," explains Dr. M. Hall, "of the excito-motory system, is a compound nerve, having a *cerebral* as well as a *spinal* origin;" and it is readily shown "that the cerebral part of the function of these nerves may be obliterated whilst the excito-motory or 'true spinal' function or property may remain unimpaired."

* * * * *

Again, "it becomes obvious that, if a nerve be compounded of sentient and excitor filaments, it has, probably, two origins, one in the cerebrum, the other in the medulla. The same remark," he adds, "is true of the nerves compounded of voluntary and motor fibres." Granting so much, and whilst acknowledging the very high merits of Dr. M. Hall, as a medical philosopher, it should be known that the genius of the immortal Gall it was which first propounded it as a fact that the medulla spinalis was *not* a mere cord of cerebral nerves. Dr. M. Hall's originality is undoubted, but it does *not* extend so far as the few words above

of a distinct system of nerves, different from the sentient and voluntary, and possessed of a peculiar and special motor power, which acts in *incident* as well as *reflex* directions, for special purposes—judging entirely from experiment. It may be viewed as a principle that every part of the nervous system, which is endowed with the excito-motory power, belongs to this system, whether this power be exerted in the direction of the nerves, *from* or *towards* the nervous centres.’ He adds :

quoted would have us believe. Moreover, the *individuality* of the spinal organism, and its consequent independence of function (so far as each one of them goes), were facts well known to not only Gall, but to Le Gallois, Walker, Bell, and even Mayo, to say nothing of Blane and Müller. I may add here, that to the best of my belief neither one of the authors I have named employed the word “sensation” in connection *ONLY* with the brain; as Dr. M. Hall seems, to me, to imply. There is not only a *conscious-sensation*, but an *unconscious-sensation*—the first is a cerebro-spinal function, but the second is one merely spinal. If “sensation without consciousness” is “a contradiction in terms” (Hall), the use of the word *perception* in reference to the brain, and *impression* in reference to the spinal cord, may be desirable.

However, the quadruple function of the medulla spinalis is, as Dr. M. Hall teaches, an interesting and important fact. The spinal cord *has* four sets of fibres; *imprimis*, those sensory and motor, or excito-motory *or* true spinal (Hall); it is made up, also, of two others, one of which is ascending whilst the other is descending—the one set goes *to*, and the other proceeds *from* the cerebrum; and inasmuch as the first imparts *consciousness*, it is called *sentient*; and because the second is for the purpose of conveying the mandates of the will (volition), it is known by the name of *voluntary*. The “true spinal” functions being of an instinctive or automatic character may or may *not* act independently of the brain, *i. e.*, the will, and of this the individual may be perfectly *conscious*; the movements of the body or limbs may be either voluntary or involuntary, or, what is the same thing, either cerebral or otherwise; but in any case these must be essentially spinal. To realise at a glance the cerebro-spinal functions we may say that they are constituted of sensation, consciousness, volition, and motion, and that these several words describe not only their very essence and quality, but, what is more, portray in their sequence the exact order of their occurrence, *i. e.*, in a state of health. But whilst the first and fourth only are concerned in the excito-motory phenomena, *i. e.*, the instinctive, automatic, or involuntary phenomena, the second and third subserve voluntary motion.

‘What are the *special* motions produced by stimulating given incident’ (*i. e.*, sensory [spinal]) ‘nerves? The most usual effect produced is a motion of the limbs. But in other instances we have acts of inspiration, of deglutition, of expulsion—of closure of the eyelids, larynx, pharynx, and the sphincters—interesting facts, which speak a physiological language, and assign distinct and special offices to certain excitor nerves.’

“In the preceding extracts from Chapter II of Dr. M. Hall’s ‘Nervous System,’ we have grouped together a series of facts, which, although confirmatory of the author’s views as to the *true spinal function*, are considered to belong both to the functions of *animal* and *organic* life; and each of these specified are essentially *automatic*, or *instinctive*, or *involuntary*.

“‘The pneumo-gastric nerves,’ Dr. M. Hall moreover affirms, ‘must be viewed, not as a mere sentient or secretory nerve, but as emphatically the *internal* excito-motory nerve.’

“In proceeding with our inquiries into this interesting department of medical science, one is naturally led to ask if we may or may not demonstrate, with the aid of the scalpel, the existence of these same incident or excito-motor nerves, to which so much is attributed? Dr. M. Hall himself exclaims, ‘What an interesting subject for the scalpel?’ The mere *idea* of Walker was demonstrated by the dissections of Bell. The one said there must be two roots for each spinal nerve, and the other exposed the same to view. Dr. M. Hall says the ‘incident excito-motor nerves’ must ‘exist:’ and Mr. Grainger in 1837 made the attempt to realise or demonstrate the assertion; with what success will presently appear. ‘One of my principal objects,’ writes Mr. Grainger, ‘has been to detect the anatomy by which the reflex power operates; and, although *this branch of the inquiry*

needs much further prosecution, I am myself convinced that a peculiar order of nerves, called the excito-motory, not only exist in the cerebro-spinal, but likewise in the ganglionic, system,' &c. In the engraving which is prefixed to Mr. Grainger's work on the spinal cord, there are represented 'certain fibres running like delicate striæ in the gray substance,' and which this gentleman 'is induced to believe,' to quote his own words, represent the separate existence of the incident and reflex nerves of Dr. M. Hall. Inasmuch as, on the frank admission of so celebrated an anatomist as Mr. Grainger, 'it is extremely difficult, owing to the delicacy of the parts, to determine the exact relations which exist between the above filaments and the gray matter,' it follows that it must be also 'extremely difficult' to persuade one's self that Mr. Grainger has really *detected the anatomy by which the reflex power does operate*.

It must be remembered that the question is, according to Mr. Grainger himself, and according also to the German anatomists—are the 'five separate fibrils passing from the anterior root of one nerve,' and 'some other fibrils' 'which were *not* so plainly seen,' in direct 'connection with the gray matter?' Granting that such a state of things *is* necessary to what may be called the anatomy of the excito-motory system, the following few words at page 36 of Mr. Grainger's book on the spinal cord would seem to imply that 'the structure above described,' viz., *fibrils*, can be traced only when 'the parts are sufficiently favorable for examination;' and this, it would seem, happened but rarely. I may add, though with all respect for the abilities and high professional standing of Mr. Grainger, that, even supposing the said fibrils formed an integral part of the spinal organism, it would then remain to be proved, experimentally or otherwise, that the same constituted the roots of the 'incident excito-motor nerves,' so designated by Dr. M. Hall; and that these are, anatomically

and physiologically, distinct from the nerves of sensation (spinal) and motion.¹

“I cannot learn that Mr. Grainger has succeeded in making out either the one or the other of these highly important positions; *i. e.*, important of course to those favorable to the excito-motory doctrines, as explained on Dr. M. Hall's and Mr. Grainger's more complicate (*anatomical*) views.

“I shall hope, in the course of the succeeding remarks, to satisfy a few at least of my audience, that the additions to the spinal organism held by the gentlemen named to be essential to the excito-motory phenomena, are, in fact, quite unnecessary; that the ‘incident’ and ‘reflex’ nerves, so called, constitute merely the nerves of ‘sensation’ and ‘motion’ (not volition) of Walker and Bell; to whose labours

¹ Throughout the writings of Dr. M. Hall, it may be observed that the words *sensation*, *volition*, and *motion*, are employed somewhat vaguely; and even in those of Mr. Grainger which relate to the spinal cord, and its physiology, the very same fact obtains. I cannot myself understand the first-named gentleman when he affirms that *sensation without consciousness is an absurdity*. Does not the spinal cord in the exercise of its peculiar function receive a “sensation” from without, and through the agency of its *incident* nerve matter,—and is not this same “sensation” altogether independent of the cerebrum—the seat of consciousness *and* volition in man and animals? In the anencephalous monstrosity, and not less in the decapitated frog, the excito-motory phenomena are readily enough demonstrated; the spinal cord in each of them receives a “sensation” from without, and through the agency of its *incident* nerve-matter; but how can “sensation” in such instances be accompanied with “consciousness?” Equally incomprehensible, indeed, are both Dr. M. Hall and Mr. Grainger, in their employment occasionally of the words “volition” and “motion.” It is not a difficult matter to perceive that the first is, not uncommonly, substituted for the second; and thus is it made to appear that the motor acts have been treated of, by former and eminent medical writers, as invariably an effect of cerebral activity or power, *i. e.*, *volition*; but must it not be conceded that Walker, Bell, and Mayo, for example sake, recognised the movements of the body and extremities, or the motive faculties—as of *spinal* origin, and *apart* from the *sensorium* (brain)?

reference has been above made ; and that a mere modification of these conditions (*i. e.*, sensation and motion), the effect of either cerebral or ganglionic influences superadded or conjoined thereto, or, in other words, the effect of the peculiar vital condition of the parts of the organism concerned, the consequence of external and accidental circumstances, is at all times sufficient in itself to account for the true spinal functions, or to explain the phenomena of these.

“ However true may be and is the conclusion, that where there is a diversity of function, there must be a diversity of structure ; yet, in this particular instance, I am wholly unconvinced that any such *diversity* exists in nature.

“ At page 262 of the ‘ Select Dissertations ’ by the late Sir Gilbert Blane, we find the following paragraph, which is important in many ways ; for it not only reveals to us the opinions of this eminent man regarding the true spinal functions, but also goes far to assure us of the truth of the peculiar views this paper is designed to establish. ‘ There are facts which show that instinctive actions, even in animals endowed with brain and nerves, do not depend on sensation (cerebral). I took a live kitten, a few days old, and divided the spinal marrow by cutting it across the neck. The hind paws being then irritated by pricking them, and by touching them with a hot wire, the muscles belonging to the posterior extremities were thrown into contraction, so as to produce the motion of shrinking from the injury. The same effects were observed in another kitten, after the head was entirely separated from the body. In repeating this experiment, I found that, when the spinal marrow was cut through, between the *lumbar vertebræ* and os sacrum, the *posterior extremities* lost their irritability, but the part below it, *viz.*, the tail, retained it. It might, therefore, be said, that the spinal marrow below the division served as a sensorium ;

but it may be answered, that, when the head is cut off, its irritability remains, as appears by the motion of the ears when pricked or touched with a hot wire; and, as the extremities are also irritable, it will not be said that consciousness and sensation exist in two separated portions of the same body. Nor can it be admitted that sensibility and consciousness may remain in the head after separation; for, if mere compression of the carotid arteries abolishes sensation and thought by interrupting the circulation in the brain, how much more must the superior violence of decapitation have this effect? In an acephalous monster, the like phenomena were observable. It moved up its knees when the soles of its feet were tickled; it performed the act of motion, passed urine and fæces, and swallowed food. *It is on record, that the same took place in the case of one in which the spinal marrow, as well as the brain, was wanting.* Sir Gilbert Blane has added: 'The like takes place with regard to insects; for, after the head of a bee is separated from the body, the hinder part will sting, upon the application of such a *stimulus* as would excite the same action in the animal in a perfect state. These facts show clearly that instinctive, or rather automatic, motions may be exerted without the intervention of the *sensorium commune*, and, therefore, without sensation (cerebral) or consciousness.' Upon the high authority, then, of Sir Gilbert Blane, we are assured that not only does the acephalous monstrosity manifest all the phenomena belonging to the excito-motory or diastaltic nervous system, but, what is a very material point, as bearing most closely on my own views, the same phenomena 'took place in the case of an amyencephalous being,' *i. e.*, of one brought into the world without either a *brain* or a *spinal cord*.

"Now, although both Dr. M. Hall and Mr. Grainger main-

tain that the 'fibrils' above mentioned, and proceeding towards the gray matter located near the interior of the medulla spinalis, are parts of the 'incident' and 'reflex' nerve matter; and are indispensable, therefore, to the true spinal functions, as explained by them; and totally distinct from the nerves of *sensation* and *motion* (*volition* is the word employed more commonly than otherwise by both these writers, and very improperly so); yet do we read the following passages in the 'Nervous System' of Dr. M. Hall, and in the 'Observations on the Structure and Functions of the Spinal Cord' of Mr. Grainger. I will add that, with my own strong convictions on this very interesting question of physiological science, I could scarcely have chosen a better form of words to convey my meaning than that which is employed by the first-named author. It will be seen to confirm, in all important particulars, the fact of the existence of the true spinal or excito-motory function in cases both of congenital absence of the cord, as well as of accident or disease involving this structure; and wherein, of course, *i. e.*, in reference to the first-named, none of the said 'fibrils' could exist; it proves, moreover, the 'record' above quoted from Sir Gilbert Blane. Dr. M. Hall has these words at page 78 of his 'Nervous System,' viz.: 'I must add that, as the irritability of the internal organs doubtless depends much on the ganglionic system, so that of the muscles of the limbs may partly depend upon this latter system. Although I have observed the irritability to be very greatly diminished by the removal of the influence of the spinal marrow, I think I never knew it to be completely annihilated under such circumstances.' Mr. Grainger writes thus at page 142 of his work, just named, and with which doubtless most medical men are more or less acquainted:—'If it be admitted that any nervous power at

all is required to effect those processes which take place in the foetus—circulation, secretion, and nutrition—and it is almost impossible to arrive at any other conclusion, it is certain that it is the agency of the great sympathetic, and not of the cerebro-spinal system, which is necessary; for it is known that the development of the foetus is, in other respects, perfected in those cases of monstrosity, in which both the brain and spinal cord are deficient. It is, then, highly probable that the ganglionic system is in action during the foetal life; and it is almost certain that this action is excited by, or dependent on, the reflex principle.' Mr. Grainger adds: 'The heart may be selected for the sake of illustration; the blood reaching the cavities of that organ, makes an impression upon the incident branches of the cardiac ganglia, the influence of which being transmitted by the reflex cardiac twigs, causes the muscular substance to contract.'

"I cannot see any reason why, after this expression of opinion, Mr. Grainger should think it necessary to suggest 'that if there be in the nervous system a power of transmitting from the skin centripetal impressions, which do not excite sensation (cerebral), and a capability of reflecting to the muscles centrifugal impressions which do not consist of *volition* (motion), there needs must be distinct orders of fibres for this purpose.' By a 'distinct order of fibres,' Mr. Grainger means that such must be, under the circumstances cited, contained in the medulla spinalis.

"It is seen that the views expressed relatively by Dr. M. Hall and Mr. Grainger in the preceding quotations—views which recognise in every way the peculiar power of the organic or ganglionic nervous system to preside over the excitatory functions, and this much without any aid from the 'fibrils' above mentioned, or from any 'distinct order of

fibres'—are in perfect harmony with those entertained by Professor Müller; who, according to the authority of Mr. Grainger himself, 'does not admit the necessity of any distinct division of the nervous system for the production of the excito-motory phenomena.'

"The following case of 'paralysis,' though quoted by Dr. M. Hall as confirmatory of his own peculiar opinions, *i. e.*, of the distinction between common sensation (spinal) and motion (not volition), and the excito-motory phenomena—as realised by 'incident' and 'reflex' nerves—is nevertheless a plain and palpable proof, not only that there are degrees of sensation and motion (as there are of any other normal or abnormal phenomena), but also that these *are* liable to be modified by various external and internal causes. I would beg the particular attention of gentlemen present to the case here quoted from the writings of Dr. M. Hall :

" 'I have this day (Jan. 3d, 1841) seen, with Mr. Duffin, a case of the most complete hemiplegia of sensation and volition (voluntary motion) of the left side, without loss of intellect, and with the perfect continuance of all the reflex actions. Respiration, deglutition, the action of the sphincter ani, are unimpaired; and the following distinct reflex actions and phenomena were observed, viz.—

" '1. On tickling the left side of the cheek, the patient complained, and the left shoulder was forcibly agitated.

" '2. On tickling the palm of the left hand, the arm and fingers were moved, but without consciousness, *i. e.*, volition.

" '3. On tickling the sole of the left foot, the extensors of the toes, and especially of the great toe, were strongly contracted; still without consciousness, *i. e.*, volition.

" 'The same effect was produced by applying a metallic spoon, just taken out of cold, and of hot water; the extensors of the toes retained their contracted condition whilst our visit

lasted. It was the third day of the disease. The general symptoms were unchanged from the beginning, so far as they had been observed.'

"Now in the stead of proving—as Dr. M. Hall declares the above case to do—the *distinction between the motions of volition* (by this expression is meant the ordinary sensation and motion) and of the excito-motory system, it appears to my mind to confirm, in language scarcely to be mistaken, the fact insisted on by Müller, viz., that there is no kind of necessity to absolutely dissociate the ordinary functions of sensation (spinal) and motion from the true spinal or excito-motory phenomena. The state of the case seems to be merely this—a man has a small clot of blood effused somewhere near the brain; and this so alters the relation of the cerebro-spinal organism and its bony covering, that the pressure which results annihilates, in part, the functions of the medulla spinalis. Its gray matter is no longer in a position to impart the ordinary power or force to the sensory and motor branches supplied to the left half of the body; and thus it follows that, in its enfeebled physical condition, the mere will or volition of the suffering party is insufficient to excite the same to the exercise of its common functions, *i. e.*, sensation and motion (voluntary); but on the application of another and more powerful kind of stimulus, viz., tickling, and the application of metallic spoons just previously immersed in cold or hot water, both sensation (spinal) and motion were plainly manifested by the patient—that is to say, motion was produced in those parts previously motionless. What the brain could not accomplish for the spinal functions, touch (of a particular kind) effected. Whilst volition failed to excite the sense, or rather faculty, of motion, tickling and cold and hot spoons placed on the integuments succeeded in arousing the dormant function; proving not only that there are degrees of sensation and motion, but also

that these even are liable to be modified by various external and internal causes—in short, that the reflex actions, very properly so called, are but an amplification, so to speak, of the ordinary spinal functions. Moreover, it should be borne in mind, that a patient, on the third day of an attack of hemiplegia, is more than likely to have his cerebral faculties, and with them his volition, somewhat out of order; and although Dr. M. Hall says that, in the case above narrated, there was not a ‘loss of intellect,’ I think it likely that the *volition* may have been somewhat affected.

“That motion, or the motive powers, may be and are either voluntary or involuntary, *i.e.*, either cerebral or otherwise, was taught by Gall, Blane, and Breschet, long before Dr. M. Hall wrote on the nervous system; and however much the latter, *viz.*, the involuntary spinal acts, are, in point of fact, excito-motory—and this the effect of incident and reflex nervous branches (there can be no physiological objection to the names), yet are the true spinal functions, *i. e.*, the involuntary the excito-motory (by which I mean those acting apart, *pro temp.*, from the brain, or independently of the influence of this important viscus), to be viewed in connection only with those parts of the cord to which are attached the anterior and posterior roots, presiding respectively over sensation and motion.

“To the following experiment I would beg to call attention. Dr. M. Hall writes: ‘You observe this living frog; its sentient and voluntary functions are obvious. I divide the spinal marrow below the occiput with the scissors; all is still. There is not a trace of spontaneous motion. The animal would remain in this very form and position, without change, until all signs of vitality were extinct. But now I pinch a toe with the forceps. You see how both posterior extremities are moved. All is now still again; there is no spontaneous motion, no sign of

pain from a wound in the neck ; it is without sensibility, without volition. I now pinch the integument. You observe the result—the immediate recurrence of the excito-motory phenomena.’ Now, what does all this prove? Just this, viz., that the connection between the brain and spinal cord being dissolved, the former is no longer in a position to animate or stimulate the latter to the exercise of its appropriate function in the animal economy. The mandates of the former are intercepted by the scalpel ; the will, therefore, to move any part or parts subordinate to the medulla spinalis is lost ; spontaneous (*i. e.*, conscious) or voluntary motion exists no longer. But the integrity of the spinal cord itself still remains, and with it, of course, those peculiar functions, viz., sensation (spinal) and motion, with which it is originally associated. Pinch, prick, or burn the integuments, and you are assured that both sensation (spinal) and motion are intact. The medulla spinalis is at one time the active agent of the brain, and responds to its suggestions, rational or otherwise ; but at other times, and under peculiar circumstances, the cord acts in obedience to other and internal stimuli—to pinching, pricking, or burning—the result of either design or accident. In the first case, there are present consciousness and volition, in addition to sensation and motion ; and in the second case there remain but sensation (spinal) and motion, or the excito-motory, diastaltic, or true spinal phenomena. And these are evidently automatic, or instinctive, or involuntary, or preservative in their very nature ; and therefore alone, and for no other reason, may be vouched to be essentially GANGLIONIC. However, in both cases, the sensation (spinal) and motion are plainly enough manifested ; but, inasmuch as the two stimuli (*i. e.*, causes) specified are as unlike in kind as they are in origin, the acts (*i. e.*, effects) themselves may be expected to be, as they are, greatly

modified, perhaps dissimilar. As Dr. M. Hall asserts, the motions of volition *are* distinct from those of the excito-motory or true spinal system; but it by no means follows that we require another anatomy of the medulla spinalis on which to engraft the latter of them.

“ ‘A horse,’ says Dr. M. Hall, ‘was struck with a pole-axe over the anterior lobes of the brain. It fell instantly, as if struck with a thunderbolt; it was convulsed, and then remained motionless. It shortly began to breathe, and continued to breathe freely through the diaphragm. When lacerated or pricked by a sharp or pointed instrument, as a pin or a nail, on any part of the face or surface of the body, it was totally motionless, manifesting no evidence of sensation or volition. When, on the other hand, the eyelash was touched with a straw, the eyelid was forcibly closed by the action of the orbicularis. When the cornea was touched, the eyeball revolved outwards by the action of the abducens. When the verge of the anus was touched, the sphincter contracted forcibly, the tail was raised, the vulva was drawn towards the anus. The upper part of the medulla oblongata was now destroyed by an instrument passed through the orifice made by the pole-axe. There were violent convulsions; the respiration ceased, and the eyelid and eyeball remained motionless on the application of stimuli. Now,’ continues our author, ‘I imagine that it will not be disputed that the blow of the pole-axe, in this case, annihilated the cerebral or sentient and voluntary functions: and that a peculiar set of excito-motory phenomena remained. Deep lacerations produced no evidence of the former; the touch of a straw induced a full manifestation of the latter. The destruction of the medulla oblongata removed all trace of excito-motory phenomena in the eyelid and eyeball. As in the experiment on the frog, the first effect of the blow is that of shock. It has been observed,

that if the blow of the pole-axe which fells the bullock be not immediately followed by the destruction of the spinal marrow (which is accomplished by the introduction of a cane) the poor animal, in some instances, begins to move, after a time, and would eventually regain his feet.'

I would submit the following remarks; viz., this experiment demonstrates a very simple fact, thus, if the brain be destroyed by violence, the cerebral functions are suspended; 'sensation' (cerebral), *i. e.*, consciousness and volition, cease; but the spinal cord is left, more or less, intact, and sensation and motion, or, if you please, the excito-motory phenomena are proved to exist, though the surface of the body is found insusceptible to external impressions. After the occurrence of violence, *i. e.*, after the forcible destruction of the brain with the pole-axe, the application of irritants to the mucous surfaces produces violent muscular contractions; a circumstance which seems to show, not that the surface of the body and the mucous membranes of the eye and of the verge of the anus are supplied with different nerves, or nervous tissue, having distinct functions, but that the sympathetic 'shock' (to quote Dr. M. Hall's own expression) of the medulla spinalis has been such as partially to suspend its functions; and, if this be admitted, what more natural than that the stronger stimulus should be responded to, whilst the weaker impression on the cutaneous nerves should be without any palpable effects. Any shock to the spinal cord would necessarily impair its functions,—such, at any rate, may be reasonably expected to be its first effect.

"The foregoing cited cases and the remarks thereon are important not only in so far as they illustrate the independence of the excito-motory phenomena on the peculiar anatomical position suggested by Dr. M. Hall himself, and

attempted to be shown by Mr. Granger ; but each one of the former is further valuable as tending to confirm my own position, viz., that the mere sensory and motor (spinal) nerves, or roots, are themselves sufficient, under circumstances, of realising all those wonderful phenomena, physiological and pathological, with which Dr. M. Hall has made his professional brethren so fully acquainted.

“To make myself understood, I must assume the correctness of those physiological principles contained in the paper I had the honour to read before this Branch in May, 1853, entitled, ‘On the Physiological Uses of the Ganglionic Nervous System.’ Therein I endeavoured to prove that the organic nervous system, with the solar ganglion for its central organ, constituted the very mainspring of all the phenomena of life ; whether they relate to the organic or to the animal functions, whether to the brain, the spinal cord, or to any individual part, or function, of the whole organism. It was shown not only that the ganglia of the great sympathetic nerve enjoyed an existence in the embryo anterior to the cerebro-spinal organism, but that its functions were perfect at birth ; and more even than this—perfect and in full operation during intra-uterine life. I took occasion to refer to two remarkable cases of monstrosity recorded by Hall and Lawrence, the one without either a brain or spinal cord, and the other without a brain, the spinal cord being perfect : in the former all the strictly vital or organic functions had been in full and complete operation *in utero* : in the latter the true spinal or excito-motory phenomena were manifested in addition to those named. From these, and from many other facts, it must be conceded that the medulla spinalis, not less than the brain, in common with the several internal viscera—as the heart, lungs, liver, stomach, etc., etc., derive their very existence and vitality from the ganglionic nervous

system, and are enabled, spinal cord and all, to exercise their several functions in the animal economy in virtue only of the specific power or influence each one of them derives from the same system. The following experiment is cited by Dr. M. Hall to prove the reverse of the above position, viz., that the true spinal functions are altogether independent of the ganglionic nervous system; and are even continued, in the frog, after the removal of the head, and with it, of course, the brain; and therefore after its influence could be experienced by the remaining structures. Dr. M. Hall writes thus: 'You see here an animal (a frog) from which the head has been separated, and, of course, I need not tell you that with the head the brain has been entirely removed; all the viscera have also been removed, and with the viscera every portion of the ganglionic system: now I beg here to repeat—the cerebrum, the centre of the spinal cord of nerves, and all the ganglionic, have been removed from this animal; and yet when I pinch the extremity it moves so as to be obviously perceptible at the remotest part of this theatre. Thus, as I said before, we have removed the centre of the cerebral system, and the entire ganglionic system. The brain, which we know to be the centre of all the sentient and voluntary nerves, has been removed, the ganglionic system has been removed, and yet you observe something remains. Now, gentlemen,' adds Dr. M. Hall, 'that which remains I venture to call—the true spinal marrow.' I have on many occasions performed the experiment on the frog as detailed by Dr. M. Hall, but I have failed to realise his results, *i.e.*, as given by him. The removal or the destruction of the ganglionic system in the frog I have always found fatal to the true spinal phenomena. The motions 'so obviously perceptible,' to quote Dr. M. Hall's own words, are the result only of a retained nervous in-

fluence, and these continue no longer than the peculiar contractile irritability of the heart, or of any other portion of the body, when removed from its organic connections. It is well known that Le Gallois, Prochaska, and Hunter taught that the nervous power is generated throughout the whole extent of the nervous system, even to the smallest nerves; and that it can exist, for a certain time, in the nerves of any part, independently of its source. I have seen the heart and alimentary canal of the shark continue their specific contractions, aye, and vigorously too, for even many minutes after I had removed them from the animal;—a fact that proves, in the words of the last-named physiologist, ‘that the nerves of a part continue the action which they receive.’ There can be no doubt that both the brain and the spinal cord constitute the mere instruments of the ganglionic nervous system; instruments or agents by means of which our individual dependency on, and relationship to, the external world are made more particularly manifest. In fact, Dr. M. Hall has himself confirmed, in a measure, this precise view of the case. At page 78 of his ‘Nervous System’ are these words (I quote them for the second time): ‘I must add that as the irritability of the internal organs doubtless depends much on the ganglionic system, so that of the muscles of the limbs may partly depend upon this latter system. Although I have observed this irritability to be *very greatly diminished* by the removal of the influence of the spinal marrow, I think,’ he adds, ‘I never knew it to be completely annihilated under such circumstances.’ Dr. M. Hall is quite right; the ‘irritability’—‘so obviously perceptible’ (and what is this irritability but a motion of a peculiar kind?) not only in the muscles of the limbs but in the internal organs,’ is, in point of fact, a function of the organic nervous system or great sympathetic, as it is commonly

called; and this 'irritability,' Dr. Hall may know for a certainty, cannot be completely annihilated by the removal of the influence of the spinal marrow. Moreover, I doubt if it be really greatly diminished by the like means, *i. e.*, the removal of the influence of the spinal marrow. It would appear rather that the specific power or function of the ganglia remains unaffected by either the presence or absence of the medulla spinalis, but that on the removal of this portion of the animal organism the *irritability* becomes indicated in a more simple manner: *e. g.*, in the brainless and marrowless monstrosity, to which reference has been already made, this irritability, it may be said, was made evident by the normal condition of the internal viscera, and by the due performance of their several functions in the animal economy, and by nothing more; whereas in the case reported by Mr. Lawrence, in which the brain was alone wanting, there the same *irritability* was indicated not only by the circumstances just mentioned, but by the addition of the true spinal, or excito-motory functions; the cord itself forming a part of the whole organism and receiving, in common with the internal viscera, the vital stimulus of the solar ganglion and its auxiliaries.¹

¹ The views of Dr. M. Hall, in so far as "irritability" is concerned, would seem to have undergone a very considerable modification, at some time or the other. Thus, if the reader will be at the pains of comparing the opinions expressed in the text, and conveyed in the quotation made from his 'Nervous System' (p. 78), with that in the following few lines, to be found at p. 36 of that gentleman's 'Memoirs of the Nervous System,' 1 and 2, he will, not unlikely, perceive the force of the remark just made—"It would seem, from what I have observed in the young of the hedgehog, and of other animals, when languid, torpid, or dying, that the voluntary motions cease first, then the respiratory motions, next those of the excited reflex function, and lastly, those of irritability, the last act of irritability being that which induces the cadaveric rigidity. *After all evidence of irritability has ceased, it is probable that the functions of the sympathetic may still continue.*"

"Such is the order, then, in which this series of functions disappears in death;

“According to Dr. M. Hall, many of the strictly vital functions are primarily and essentially spinal; thus he treats of the several acts of ingestion and egestion, by which is meant respiration, deglutition, the action of the sphincters, and so on, as parts of the excito-motory system; and so also of the uterine function. I feel perfectly satisfied in my own mind that Dr. M. Hall has failed in this particular in making good his position: he has certainly mistaken the effects for the cause. The former he has in many respects well described and ingeniously and beautifully illustrated; but as to the latter, I feel he has much to learn.

“One important act of ingestion, viz., respiration, he makes dependent on the pneumogastric nerve and which he has designated the internal excito-motory nerve. With what amount of success will presently appear.

“If the nervus vagus be what Dr. M. Hall declares it is, viz., the excitor of respiration, I am at a loss to account for the circumstance, that in the words of Mr. Grainger, ‘birds, and even dogs, and other animals, have been known to survive the division of these nerves several days.’ The assertion of Mr. Grainger is proved by the experiments of Sir Benjamin Brodie and others of like eminence. Nor was Dr.

an order which is inverted when the same functions and their appropriate organs gradually come into existence, in the foetal and natal states, and in the progressive series of the animal kingdom. *The movements of the foetus in utero are entirely phenomena of the reflex function:* they occur in the anencephalous, as well as in the perfect, foetus. This function and the irritability constitute, indeed, the principles of life and motion in the foetal state.” How, I would ask, can the irritability of the internal organs as well as that, in great part, of the muscular system, be dependent on the ganglionic system, whilst, at the same time, “the movements of the foetus in utero are entirely phenomena of the reflex function?” Again, if *irritability*, regarded as a function of the ganglionic nervous system *cease*, how can it be “probable that the functions of the sympathetic may still continue?”

M. Hall unaware of what I now assert, when engaged in the composition of his 'Nervous System;' for in order to anticipate the difficulty which lay in the way of his proving the excito-motory function of the nerves in question, he tells us that it is nevertheless possible for the respiration to be continued even though both pneumogastric nerves be cut through—but that in this case respiration is plainly the result of voluntary action, *i. e.*, of a cerebral influence. Dr. M. Hall's words are these, viz., 'In fact respiration may be a voluntary act, induced by the agency of the cerebrum, the pneumogastric nerves being divided; or it may be an excited act, excited through the agency of the pneumogastric nerves—the cerebrum being removed.' He adds, 'If, in this latter circumstance, the pneumogastric nerves be divided the acts of inspiration cease.' The difficulty in which Dr. M. Hall thus places himself will be at once perceived. It is by no means an easy thing to persuade oneself that this agency of the cerebrum, *i. e.*, volition, could be so continued, without a moment's interruption or cessation, and for a period of several days, in the dog, or in any other animal whose pneumogastric nerves had been cut through. Truly the respiration is a mixed function, but not, I think, so mixed as Dr. M. Hall maintains. It is doubtless a function which depends for its integrity not only on the true spinal system, but on the ganglionic. The brain may or may not take cognizance of the respiration; it does so, generally, only under circumstances of disease. The respiration, Dr. M. Hall tells us, is an act of the excito-motory or true spinal system, excited through the medium of the pneumogastric nerves, but regulated and controlled by volition; respiration, on the other hand, appears to me to be, like all the other automatic or preservative functions, at all times, and under all circumstances, an act essentially and primarily of the organic or ganglionic nervous system; and secondarily, and

as an effect only, of the spinal system. For this very palpable reason, it is continued and preserved in all its integrity, in each one of us, during something like seven or eight hours in the twenty-four, or so long as either of us may sleep; during the whole of which time the brain, medulla oblongata, and spinal cord are in a state of abeyance, in a state of suspended animation, so to speak. The greater activity of the respiratory function during our waking hours is maintained by an additional agency, viz., the medulla spinalis, or that portion of it designated by the late Sir Charles Bell, the respiratory track; the large quantity of grey matter herein located being the source of such an amount of power, that, like the cineritious substance of the brain, its activity is, to a very great extent, independent of the volition.

“I may add, that although the agency of the pneumogastric nerve may be imperfectly understood, yet does there appear much reason to believe that, as Sir C. Bell suggested, ‘it combines the movements of respiration’ by the strict relationship which is established between it and the brain, through the medium of the medulla oblongata. The various and not unfrequently grotesque positions and movements assumed, voluntarily, by patients suffering from diseases affecting the heart and lungs, and parts subordinate thereto, would seem to justify the idea of the existence of some especial power whereby such ‘relationship’ is provided for.

“Digestion is far from being an excito-motory act, as Dr. M. Hall teaches. Like respiration, digestion in man and animals is capable of being performed without the cerebro-spinal axis, and therefore without the pneumogastric nerves. I need only refer to the facts stated by Sir B. Brodie, for confirmation of this statement.

“The peculiarities which distinguish the intra-uterine life

of the monstrosity recorded by Dr. M. Hall himself, in which there existed neither brain nor medulla spinalis, assure us that all the strictly vital functions are independent of the true spinal system ; and afford us, too, a very good reason to believe that the contractility of the internal viscera is altogether dissociated from the diastaltic nervous power. In this miserable object—sent indeed ‘into the world before its time, and not half made up’—as in others of the same kind, the internal excito-motory phenomena were performed with only a ganglionic nervous system ; not only were its several parts duly nourished and perfected, and maintained in all their integrity, without any aid from the spinal cord or its nerves, and with only the ganglia of the great sympathetic ; but what is a very material point, the sphincters performed their office, or otherwise, I take it, the liquor amnii would have found its way into the cavities of the chest and abdomen, and the contents of the intestinal canal, *i. e.*, the meconium, would have passed *in utero* ; and neither the one nor the other of these circumstances were among the ‘peculiarities’ of this very remarkable case.

“ Now, if, for convenience sake, we divide the phenomena of the excito-motory system into two, viz., the external and internal (an arrangement by no means artificial, but in strict accordance with the facts of medical science), and consider the former of these as manifested through the medium of the medulla spinalis, whilst the latter are made evident in the continuous action of the internal organs ; by which I mean the heart, and lungs, and alimentary canal, and so on, including the sphincters, those placed superiorly, and guarding the inlets to the chest and abdomen, as well as those placed inferiorly, as the sphincters belonging respectively to the bladder, uterus, and rectum,—we should expect, *à priori*, that both of these functions, or rather sets of functions, that is, those ‘external’ and ‘internal,’ were, as they really

are, but parts of one whole, resting on one anatomy and physiology, so to speak; and, moreover, that each one of these (sets of functions) was dependent, at all times and under all circumstances, for its healthy manifestation or otherwise, on one and the same portion of the organism; but, according to Dr. M. Hall's showing, both the external and internal excito-motory phenomena, as above cited, are now and then, and under peculiar circumstances, dependent on distinct parts of the animal fabric: thus, whilst he refers the one, when they occur to the body in a normal state of being, to the spinal cord *exclusively*, he looks on the other, in cases of abnormal development, as in the amyencephalous monstrosity, as belonging or due to the sympathetic nerve. The fact is this: both the external and internal excito-motory acts belong primarily to the ganglionic nervous system; this portion of the nervous organism it is which, forming in itself an essential and integral part of the animal tissues, in all their variety, not only creates within itself the vital stimulus to action, but gives power, *i. e.*, life to the entire organism—endows with force and energy the several parts of the animal machine. To the peculiar organic condition of each part or viscus is to be referred the individual and specific characteristics of this said force and energy, as manifested in either the one or the other of them; whether in the brain or spinal cord, the heart or bronchial tubes, the alimentary canal or sphincters, and so on through the whole body. These several organs named respond, each in a particular way, to its appropriate stimuli; the brain, to the impressions or sensations conveyed to it through the medium of the external senses; the spinal cord, to the impressions or sensations carried to it by its sensory or incident (excitor) nerves; the heart, to the impressions or sensations conveyed by the current of the blood over its delicate mucous (internal) surfaces; and similarly of the bronchial tubes,

the alimentary canal, and the sphincters. The 'external' excito-motory phenomena are more apparent, both because they *are* external, and because the spinal cord is in itself the great, the principal, medium for their manifestation.

"At p. 74, chapter ii, of Dr. M. Hall's work on the 'Nervous System,' we read thus: 'That the action of the uterus belongs to the same excito-motory system, seems to be proved by the expulsion of the foetus after the cessation of respiration.'¹ 'A case,' continues Dr. M. Hall, 'is detailed

¹ In the very practical and admirable lectures of Dr. A. S. Merei, of Manchester, "On the Diseases of Children," published in the 'Association Journal,' are these words, viz.:—"Paralysis, either of the ovaries or uterus, can be but rarely witnessed except as an accompaniment of that universal malady which has been already treated of while discussing the affections of the brain and nervous system. The total paralysis of the ovaries it would be difficult to prove at all, though it sometimes occurs in the womb as an accident during labour, or immediately after it, when, by non-contraction, it gives rise to hæmorrhage and other dangerous consequences requiring instant and decided interference. Most commonly, however, this is but a temporary condition, which is subdued by the usual treatment of confining the uterus within the grasp of the hand, or compressing it within the circumference of a large cup or bowl, applied by force over the abdomen, or by exciting the internal surface by the points of the fingers, and the administration of ergot and other uterine stimulants. That such defect of nervous action is uncommon in the uterus might be readily guessed, considering how very frequently that organ is able to perform all its functions, while the rest of the body, or of the general cerebro-spinal nervous system, is in a state of abeyance or torpitude. Thus it will act quite freely in idiotcy, in spinal paralysis, in the stupor of typhus, or apoplexy, or under the influence of chloroform, and even after death itself—that is to say, somatic death, death of the cerebro-spinal axis, or, conscious being—the ganglionic or vermicular sensibilities, so to speak, being partially effective. Hence, in the dead-house, there has been such a thing as *post-mortem* expulsion of the foetus, I will not say how long after apparent death, but certainly after the heart and lungs have ceased to act under ordinary stimulants, or after the woman has been considered dead, and carried away. But though complete paralysis be a very uncommon occurrence in the womb, torpitude both of that viscus and of the ovaries is by no means unfrequent. Such a condition may arise from original constitutional defect, or from a morbid state of the blood, or from long-continued pressure of the fæces,

by M. Ollivier, of paraplegia, in which parturition took place without difficulty.' This paraplegia, we are told, arose from

or common tumours, or certain affections of the brain or spinal cord, communicating their deadening influence to the local ganglionic nerves, and thus blunting their sensibilities. Hence we may have a sexual indifference, with deficiency of the natural passions, and a purely functional amenorrhœa. The girl or woman may," &c. &c.

The eggs of a certain hen-fowl in my possession, at the moment I write, are not only extremely small, being no larger than the egg of a common house-sparrow; but, what is most singular and peculiar, is, the shell contains only *albumen*; in no single instance has anything like a *yelk* been discovered. This circumstance is to be referred, most probably, to either some congenital defect of one or both ovaries, or to a "torpitude" of these organs. Whilst on this subject, I will, in order to bring the subject matter of the text down to the present time, introduce to the reader's attention the annexed opinions of Dr. W. Tyler Smith. The reader is referred to this gentleman's instructive lectures "On the Theory and Practice of Obstetrics," as contained in the pages of the 'Lancet' for 1856:

"We now come to the consideration of peristaltic action, or ganglionic motor action.

"When any part of a muscular organ supplied in whole or in part by the ganglionic system of nerves is irritated, the contraction which ensues generally spreads in a vermicular manner to a distance from the point of irritation, and continues for some time after the exciting cause is removed. This is called peristaltic motion or action. The uterus is eminently endowed with this peristaltic form of contraction. When one point of the uterus is stimulated, through the abdominal parietes, or by the introduction of the hand into the uterus, the contraction excited extends to the whole organ. Harvey described this peristaltic action of the uterus in the doe. William Hunter saw it in the cat and the rabbit. Müller observed it in the uterus of the rat and the oviduct of the turtle; and I have seen it in the uterus of the guinea-pig and other animals. The heart, œsophagus, and intestine may be excited to contraction after death; and I have seen the uterus and vagina of the rabbit contract rhythmically, when irritated, for several hours after the cessation of respiration. Many cases are on record in which women have died undelivered, but the child has been expelled spontaneously after death. In one case, a woman dying during labour was placed in a coffin, and the fœtus was found the next day perfectly expelled. This post-mortem parturition must generally depend upon peristaltic action, commencing after the occurrence of somatic death, or upon the rigor mortis

the pressure of 'acephalo-cysts' extending from the fourth to the first dorsal vertebræ. Brechet, however, details a similar

affecting the uterus. It is well known that the rigor mortis affects the other involuntary muscles, and especially the heart, which is contracted by this influence to such an extent as to empty the ventricles, and even to simulate concentric hypertrophy. Cases are related in which the fœtus has apparently been expelled some days after the death of the mother by the gaseous distension of the abdomen; but these are different from cases occurring shortly after death, and before decomposition has set in. In the living subject, the peristaltic action of the uterus is the basis of the other uterine actions. In natural labour it is combined with reflex uterine action, and with various forms of extra-uterine action; but, under certain circumstances, it seems able to effect the expulsion of the child without other aid. In paraplegia from disease of the lower part of the spinal marrow, or in animals reduced to the same state by experiment, the peristaltic action is the chief power remaining to the uterus. In such cases, delivery has been effected in an imperfect manner by the peristaltic action of the uterus, or the application of galvanism to the organ. It is not, however, known how much of the spinal marrow must be destroyed before the reflex or diastaltic actions of the uterus cease.

" Certain experiments have been performed by various physiologists, with a view to determine the nature of uterine action. M. Serres found that on dividing the spinal cord in gravid animals before the time of parturition, death ensued at variable intervals, but abortion did not necessarily occur. He then divided the cord in animals after the commencement of parturition, and the process was arrested. In other experiments, he excited abortion in animals by irritating the spinal marrow in the lumbar region. M. Brachet divided the cord in guinea-pigs between the twelfth and thirteenth dorsal vertebræ, after the commencement of labour, and everything but feeble contractions of the uterus were arrested, the animals dying in a few days undelivered. M. Segalas made a section of the cord high up, without influencing the uterus; but the organ was paralysed when the division was practised low down. Cases are detailed by MM. Brachet and Ollivier, as occurring in the human subject, in which, in paralysis depending upon disease high up in the spinal marrow, uterine action was not interfered with, but was diminished or suspended altogether in cases of paraplegia, the result of injury or disease, low down in the cord. Dr. Simpson has, I have understood, performed some experiments upon pigs which go to negative the experiments of MM. Serres, Brachet, and Segalas. In Dr. Simpson's experiments, which have not been published, I believe parturition occurred notwithstanding the destruction of the lower portion of the spinal marrow.

case of paraplegia, in which parturition proceeded with extreme inertia. The discrepancy in the two cases is thus explained by Dr. M. Hall: 'In the former case, the disease was *above* the origin of the cauda æquina; in the latter alluded to, it was seated *below* that origin.' 'In the latter case, the central or connecting link between the incident and reflex nerves would be wanting, and the reflex functions would consequently cease.'

"If I were asked, in a casual manner, for a good and plausible reason for discrediting in great part the opinions of Dr. M. Hall, in so far as the true spinal functions are concerned in the parturient process, I should have no hesitation in referring my inquisitor to the fact that the fœtus has been known to be expelled even through and without the vagina, by the contractile efforts of the uterus AFTER the respiration has ceased, and therefore *after* the cessation of all the spinal functions. I have not myself witnessed this phenomenon, but as a *fact* it is well known to us all: however, in 1849, when living at Ceylon, I was one night sent for in great haste by, I may say, a body of Malabar and Cingalese medical practitioners, who informed me that a patient of theirs, a native lady of some position, had suddenly died in the course of a protracted labour; and begged that I would give them my assistance to endeavour to save the life of the child. I made all the haste I could, and, on arriving at the house, lost no time in laying open the uterus through the abdomen, or, in other words, in performing the Cæsarean section, and so readily enough extracted the child. What forcibly struck my attention was the muscular power which yet remained to

If Dr. Simpson's results are as I have stated, they will not prove the independence of the uterus of reflex action, since from the connections of the greater and lesser splanchnic nerves, and the thoracic, abdominal, and pelvic plexuses and ganglia, it is quite possible that the uterus may receive spinal fibres from the upper part of the spinal marrow."

the uterus; so palpable and well marked was it, that some even among the bystanders expressed their surprise by an ejaculation peculiar to the eastern world; and which, to those who have ever sojourned in the east, is well known.

“Under the ordinary circumstances of death, it is well known that the functions of animal life are first suspended; the brain loses its power; volition and consciousness cease; and the spinal cord follows in the impending ruin: lastly, the functions of *organic* life are involved, and the viscera of the great internal cavities, viz., the *thorax*, *abdomen*, and *pelvis*, fail their wondrous offices in the animal economy. These latter, viz., the organic functions, it is seen, then, not only precede the former, *i. e.*, the animal functions, but what is more, outlive them (they have existed without them *in utero*, and may yet do so again); and thus it happens that, ‘after the cessation of respiration,’ and *after* the *cerebro-spinal life*, the foetus may be, and is occasionally, expelled from the uterus. The uterus must be, in common with the several organs within the thorax and abdomen, independent of both the brain and spinal cord, and intimately and indissolubly connected with the ganglionic nervous system; from which alone it derives its peculiar power and vitality, both in the pregnant and unimpregnated states.

“In the cases of *paraplegia* quoted by Dr. M. Hall from the experience of Ollivier and Brechet, the ‘discrepancy’ noted, or rather the speedier termination of the parturient process in the one case as contrasted with the uterine ‘inertia’ of the other, is, it would appear to me, to be referred, not to the relative position of the spinal affection in either case to the cauda æquina, whereby the *excito-motory* phenomena were or were not interrupted, but rather to the peculiar state or power of the ganglia of the great sympathetic. If in those cases where the *respiration has ceased*, or, what is the same

thing, the cerebro-spinal axis is, to all intents and purposes, *dead*, this much neglected and little understood portion of our nervous organism is found sufficient to enable the uterus to expel its contents, surely there can be no reason to doubt that the same structure it is which, in cases of paraplegia, such as those narrated, causes the successful expulsive efforts of the same organ. It is strangely enough assumed by Dr. M. Hall that the patients of Ollivier and Brechet suffered from just so much spinal disorganization as would deprive each of them of the functions of *sensation* (spinal) and *motion* (Walker and Bell), and no more; and that therefore the 'diastaltic' or 'true spinal function' was left intact; and hence the commencement, progress, and termination of labour in either case.

"Between the years 1840 and 1852, I had the medical charge of very many hundreds (I may say of thousands) of insane persons; and it has therefore fallen to my lot on many occasions to be called on to attend females afflicted both with cerebral and spinal disorders, in their confinements; and I do not hesitate to affirm that the experience I have had goes far to prove that the action of the uterus is, for the most part, independent of the condition of the medulla spinalis.

"The following case is so much to the point, that I will mention it here:—

"In 1848, I had under my care at Ceylon a lady, the subject of a large collection of hydatids *in utero*; these were the consequence of an early miscarriage. The peculiarity of the case consisted in its being complicated by a general and complete paralysis of the upper and lower extremities, including also the trunk of the body; there was present a universal anæsthesia (the integuments were everywhere insensible to touch or feeling); and the muscular system was,

as a whole, without power or motion. Articulation and respiration were continued with great difficulty, and the power of swallowing (deglutition) was performed only with a very sensible effort. The history of this case,¹ which is both long and interesting, went to convince me that the morbid state and contents of the uterus were the cause of all the symptoms just mentioned; and I advised, therefore, the dilatation of the os uteri by artificial means, in the hope that the contents of the womb, whatever they may have been, should be got rid of. After some delay, I was allowed to adopt this very necessary and indispensable proceeding. I dilated the os uteri with the largest sized bougie, on two different occasions; and, after some thirty hours, the expulsive efforts of the uterus terminated, and most satisfactorily, in the discharge of a large quantity of hydatids. My patient recovered after some time, and is at this date in perfect health.

“Now, I would have it borne in mind that this lady was more than paraplegic (in Dr. M. Hall’s acceptation of the word) she was without the excito-motory or true spinal functions; these had even failed to manifest themselves in her case; and nevertheless the uterus responded well and completely to the manipulations practised. And, what is more, the contractions of this organ being once excited, were continued in the most natural manner possible, and terminated only when the hydatid mass was expelled.

“Here then, alone, we are supplied with a strong position against that theory of Dr. M. Hall’s which assigns the efforts of parturition to the medulla spinalis—or, to write more strictly, to the excito-motory system.

“Such, then, are my reasons for believing—

¹ See case in Ranking’s ‘Abstract’ for 1850.

“1. That the more complicated anatomy of the spinal cord, suggested by Dr. M. Hall, and sought for by Mr. Grainger, has not yet been realised.

“2. That the mere sensory and motor nerves or roots are themselves sufficient to the integrity of all those phenomena called excito-motory, which emanate from the spinal cord; or, in other words, that there is no necessity for any distinct division of the nervous (spinal) system, for the production of the excito-motory phenomena.

“3. That the exercise of the functions of the spinal cord is due to the peculiar influence of the ganglionic nervous system, exerted on its organism.

“4. That both the external and internal excito-motory phenomena are alike dependent on the vital stimulus imparted by the great sympathetic nerve; and, in the former instance, through the instrumentality or medium of the medulla spinalis.

“5. That such is the relationship between the great nervous centres, viz., the brain, spinal cord, and the solar ganglion, that the second (viz., the spinal cord), being at one time under the dominion of the first, *i. e.*, the brain, and at another time under that of the third, *i. e.*, the solar ganglion, and being thus intermediate, will now manifest a cerebral or voluntary power (and this the result of consciousness, and, of course, volition), and then (the antecedent circumstances being dissimilar) display one of an involuntary, automatic, or instinctive, or excito-motory character; but this only, of course, when the organic nervous apparatus is in the ascendant, and the brain comparatively quiescent—or, in other words, when sensation (spinal) and motion, and not conscious-

ness and volition (cerebral attributes) are in operation; if I may be allowed so to express myself.

“6. That the great sympathetic nerve is endowed with a specific and independent power, to which both the brain and spinal cord, and with them, of course, their functions are subordinate.”

NORTHWOODS, NEAR BRISTOL;

April, 1854.

CHAPTER III.

ON THE PATHOLOGY OF THE GANGLIONIC (SYMPATHETIC) NERVOUS SYSTEM.

It is quite impossible to reflect either on the anatomical relations established between the ganglionic system of nerves and the entire organism, or on the physiological positions advocated in the foregoing pages, without, *à priori*, feeling certain that the great sympathetic nerve must be, either directly or indirectly, concerned in every variety of abnormal action which we may witness.

If, as I have attempted to show, the perfectibility and continuation of every vital phenomenon depend on the normal action of the sympathetic or ganglionic nerve-tissue which is distributed to the several bodily organs—to the brain, spinal cord, heart, lungs, liver, stomach, spleen, kidneys, intestines, and integuments—then must it follow that disease of neither one nor the other of these several parts can obtain, independently of the ganglionic nerve structure entering into its composition : a proposition this so palpable could, I imagine, be hardly questioned. There can be little doubt that pathologists have hitherto given too exclusive an attention to the *effects* merely of diseased action ; and that they have been, generally, too content to regard such *effects* of abnormal action in the system as the disease itself. In all post-mortem examinations, it is curious to mark the anxiety and fidelity

with which the operator and his assistants unravel and describe the colour, form, consistence, &c., &c., of an unhealthy portion of organism ; whilst, at the same time, you seldom hear one word mentioned in allusion to the *cause*—its nature or seat—of the pathological change or changes observed. The human heart may be seen as large as a buffalo's or elephant's, or as small as that of a rat or sparrow ; the liver may be as pale and bloodless as the countenance of an Anglo-Indian, or as deep-coloured and injected as the nasal extremity of a bacchanalian ; the brain may be as hard and impenetrable as a Dutch cheese, or as soft as oil ; and although either one of these assumed facts may be as clearly and forcibly expressed as possible, yet you will rarely hear any attempt at an explanation offered as to its *cause*. It is by no means wished to be understood that I do not attach very much importance to such inquiries as those which characterise the labours of Baillie, Bright, Andral, and many others ; but I would claim yet a more searching investigation into those changes in a portion of our organism (the ganglionic nerve-structure) which must have preceded and accompanied those more palpable and demonstrable to our senses.

It was long since observed by Dr. Copland, that “ changes may take place in the nervous system sufficient to cause the most acute disease, or even to subvert life, without being so gross as to be demonstrable to the senses ;” and nothing can be more true. As a proof of this, I may mention that during my official connection with the Hanwell Asylum, it happened that in eight per cent. of the cases examined, *post mortem*, there were discovered no indications or appearances of disease to account for death. However, it not unfrequently happens, that very positive opinions are given to the world, in criminal and other cases, based on the assumption that in every case of unexpected or sudden death, and so on, it is within the grasp of medical science to demonstrate a sufficient cause,

and to point out, in this or that structure or portion of the organism, the reason why the vital functions could be continued no longer. *Apropos*: Some years since, and on the occasion of the execution of one Blakesley for murder, a question was raised as to the insanity of the culprit named. An examination of the body took place at the Old Bailey; and it was then formally reported to the public, through the medium of the press, that inasmuch as Blakesley's brain had been examined with great care, and no sign or appearance of altered structure or disease discovered, all idea of his *insanity* must be given up. But the inconclusiveness of such a position is certain, and well shown by the circumstance above stated, viz., that eight per cent. of the inmates of the Hanwell Asylum, when carefully examined, *post mortem*, reveal not only nothing like an alteration of structure; but, what is more, and to the point, of every hundred persons dying in a lunatic asylum, and of course insane, so many as eight of such are free from any appreciable alteration of structure involving either the brain or its membranes.

Whether we look to the nosological arrangement of Cullen, or the more modern and philosophical classification adopted by Good and Mackintosh, among other writers, we are afforded merely a series of details of disease, or abnormal function of the heart and its vessels, of the brain and spinal cord, of the respiratory system, of the digestive, urinary, and generative systems. We look in vain for any information concerning even the morbid state of the blood, and as for the organic nervous system—the moving power of the whole, the main-spring of the entire organism, under circumstances both of health and disease—there is hardly any notice taken of it.

I have much pleasure, then, in calling attention to the following remarks from the pen of Dr. Kreysig; they are quoted by Mr. Lee, in his 'Mineral Springs of England.'

“Physicians are in the habit of regarding the solid parts as the primary agents of life, to which the fluids are subordinate; but, on the contrary, the blood and the *nervous substance* are the primitive and essential instruments of all the organic functions; while the solid parts occupy an inferior grade, and are but of secondary importance in disease. The elements of general and internal disease, or the morbid predispositions which form the most important objects of treatment, may, then, all be reduced to vitiated states of the blood, and of the lymph; *or to derangement of the nervous system.*” It may be assumed, nevertheless, that neither the “blood” nor the “lymph” would be likely to become *vitiated*, generally speaking, if it were not that the organic nervous system is primarily affected.

The organic nervous system, like every other portion of the organism, may be, of course, affected by either acute or chronic disorder—by either an augmented or diminished sensibility—*i. e.*, an excess or decline of power—as well as by either permanent or temporary derangement of function; and this the consequence of the intensity, duration, &c., of the sufficient cause of diseased action in the system. Moreover, the ganglionic nerve-structure may become affected partially, *i. e.*, in this or that locality, within the abdomen, or chest, or pelvis, or cranium; in the trunk or extremities, on the surface of the body or in parts deeply seated, and so on. The origin or cause of such diseased conditions, both those general and local, may be either external or internal, or both; that is to say, may consist in malaria, change of temperature, errors in diet, violent mental emotions, as fear, physical injury, loss of blood, &c. In a word, the ganglionic nervous system obeys the same laws, both under circumstances of health and disease, as any other portion of the body, and is subject to precisely similar organic necessities.

Presuming thus far, it will not be doubted that if, as has

been shown, the nutrition, secretion, exhalation, absorption, &c., as manifested throughout the whole organism and its parts, and as realised through the agency of the *capillaries*, are nothing more or less than the functions of the ganglionic system of nerves, it must follow that all deviations from the healthy state of the same functions can be accounted for in no other way than by referring them to certain changes in the *vital affinities* of the solids and fluids of the body, and which must be regarded as resulting from a depraved action of the whole, or a part, of the organic nervous system.

Should a person, therefore, be attacked with acute inflammation of the intestines or liver, or of the mucous lining of the air-passages, from exposure to cold, the capillary circulation is first obstructed, from a morbid impression acting upon the minute and cutaneous extremities of the vital nerves, which being transmitted to the sympathetic (internal) ganglia, has the effect of developing diseased action in the body. In one instance the intestines may be the predisposed organs, in another the liver, in a third the respiratory organs, and so on, according to original peculiarities of the organism—*i. e.*, temperament. Inflammatory action being once established, there is then no predicating what the consequences might be. The *nutrition* of the organ affected is of course interfered with, and its *secretion* is changed both in quantity and quality. Incurable disorganization of its peculiar structure, that is, *abnormal nutrition*, might succeed, and the individual so affected is then doomed to a life of ill health.

It is evident that in febrile diseases, whether caused by exposure to cold, or by miasma, or by the inhalation of putrid animal matter, the capillary circulation is likewise affected; either that of the skin or the mucous lining of the respiratory organs, and from the very same cause, *viz.*, a morbid impression acting upon the minute and terminal ramifications of the vital nerves; which being transmitted internally, or to

the ganglia of the great sympathetic, has the effect of developing diseased action in the body.

In fevers we are afforded the most satisfactory evidence of the seat of the disease, viz., the ganglionic nervous system—*e.g.*, all the vital functions are more or less interrupted and depraved, not only those of the abdominal and thoracic viscera, but even those of the brain and spinal cord. The stomach cannot retain its contents, or it loathes food ; the liver ceases to secrete healthy bile ; the intestinal and renal excretions are no longer indicative of health. The heart's action is hurried or oppressed in some way, as is also that of the lungs ; and the expired air contains very much less carbonic acid than it ordinarily does. The cutaneous secretion is also affected. The patient is delirious or incoherent, and the impaired sensations and motive power indicate some altered and depraved action of the spinal cord. Fever, strictly considered, must be understood to mean an impairment of all the vital functions, or precisely that which attends on a blow over the epigastrium (*solar plexus*), or on the receipt of any serious bodily injury, as well as on the occurrence of any great alarm. In these several instances the same effects *modified*, result from various causes ; but in each one the ganglionic nervous system is chiefly affected ; and as an inevitable consequence, the nutrition, secretion, &c., are interrupted—the vital functions, in fact, are threatened with a suspension.

In cholera, as in fever, we observe the very same kind of phenomena, the only difference being that they differ in degree. In some instances of intermittent fever which I have met with in Ceylon, and, during the very early period of my medical career, in Bengal and China, I have noticed that during the cold stage the collapse has been hardly less alarming than in cases of “cholera asphyxia ;” and the only real difference has been, that in the former the disease was

succeeded by a more distinct febrile reaction than the latter; and, as a matter of course, it recurred after a definite period.

In both fever and cholera, then, we witness the operation of a similar morbid action on the system; but the effects are necessarily various in the two disorders, though they may, and do, partake of one common character, viz., a deprivation or partial suspension of the vital functions.

If in either fever or cholera the heart and its vessels did continue to beat with their accustomed and normal energy, if the lungs still retained their power to decarbonize the blood, if the liver continued the secretion of healthy bile, the stomach to perform its office in the animal economy, the intestinal absorbents to take up the chyle, the kidneys to secrete their peculiar fluid; and if the brain and spinal cord proceeded with their natural functions, then only could I doubt that in both forms of disease the ganglionic nervous system is the first to suffer.

Now several writers on cholera have located the disease in the heart. Doubtless the heart's action is invariably much affected, in what is called *cholera*; but I would submit that the alarming vital depression, or syncope, which constitutes so prominent a symptom, does not in any way indicate that the *heart* is the organ first affected; but merely that it partakes, in common with every other organ, and, in fact, the whole body, of the abnormal effects of the primary morbid action. The fatal depression in cholera, consisting in the complete annihilation of the action of all the vital organs, may be at any time simulated by pressing the solar ganglion on the fore part of the bodies of the vertebræ, over which it lies.

The reader is no doubt aware that, many years ago, Dr. Stevens wrote a very learned book to prove that the cause of *cholera* was seated in the blood, and consisted in a deficiency

of the saline matter of that fluid. There can be no doubt that the Doctor has mistaken the effects of disease for its cause. According to his own showing, the abstraction of nervous energy, acids, alkalies, and electricity, &c., will cause the decomposition of the saline matter, and give to the blood a dark colour, &c. If the retention of carbonaceous matter in the blood, the effect of the impaired nervous power of the lungs (and which Dr. John Davy assures us takes place in every case of cholera and fever) will decompose it, and make it assume the same physical and chemical characters which Dr. Stevens claims for the blood in cholera and fever, then alone is there strong reason to doubt his theory.

It appears, on the whole, that the efficient agent of these diseases, so named or recognised, acts primarily on the organic nervous system; and that this fact is made evident by the parts or organs with which it is connected, being those first affected; as shown in the disordered state of the respiration, circulation, digestion, secretion, and animal heat, &c.; and, further, that the cause of *death* in cholera and fever is first owing to the operation of a poison on the ganglionic system of nerves, checking the whole of the vital functions; secondly, to an effect arising out of that cause, consisting in the discontinuance of the normal chemical changes in the lungs, thus producing blood which is unfit for the support of life.¹ Moreover, the inflammatory disorganizations which are so frequently seen in autopsic examinations of those who die from cholera or fever, are to be viewed as the results of a subsequent abnormal action, the mere effects of the first morbid impression.

Twining, Alison, and Billing, I may add, have all remarked the identity, generally, of fever and cholera; and the circumstance of their passing by insensible gradations, as they

¹ See a paper on the Pathology of Fever and Cholera, in the 'Lancet,' by myself, in 1836.

oftentimes do, into each other, proves as much ; and certainly no observer can help noticing the analogy between the stage of collapse in cholera, and the cold stage of intermittent fever—in both we have the suspended state of the vital function, the coldness and lividity of surface, and the anxious and retracted countenance. The subsequent reaction, in each, is not uncommonly of the same febrile character ; with occasional congestion of the internal viscerae.

But this syncope, this “suspended state of the vital functions,” &c., is not always succeeded by “reaction.” The morbid impression on the great sympathetic nerve, is occasionally so intense as to utterly and irrecoverably prostrate the patient—to kill him outright. *Asphyxia*, without the *cholera*, is not uncommon. I have seen and treated several such forms of disease ; such cases are the most dangerous, and, as may be expected, the most frequently fatal. The very first case of *Asiatic cholera*, so called, which came under my notice on my arrival at Calcutta in 1834, was that of a sailor on board my own ship. He was occupied in the *hold*, but being unable to proceed with his work from “faintness,” I saw him. The poor fellow was nearly moribund ; he presented all the peculiar characteristics of genuine cholera, with the exception of vomiting and purging ; there was not in him *vitality* sufficient to develop these ordinary symptoms ; and it was left, therefore, to myself, as his medical attendant, both to increase the vital power, ebbing so rapidly, as well as to stimulate the alimentary canal to the discharge of whatever abnormal and irritating fluids they contained—and not the less to restore, by a judicious eliminative treatment, the functions of the several organs affected. The late Mr. Twining, in his excellent work ‘On the Diseases of Bengal,’ writes of cholera thus : “The recovery or death of the patient, as the case may be, is sometimes as sudden as either from submersion in water.” Another medical writer

has asserted, that he has known instances of cholera patients being "knocked down dead as if by lightning." (See Twining and Bell on Cholera.)

Now in reference to the case of the sailor above mentioned, I have remarked that *there was not in him vitality sufficient to develop the ordinary symptoms of vomiting and purging*; this view of the circumstance, I may add, is confirmed by the expressed opinion of Dr. Copland; who, in the article "DISEASE," in his 'Dictionary of Practical Medicine,' and when illustrating the changes which occur in the secretion of the intestinal mucous surface, has these words, viz. : "A morbid increase of these fluids is usually an acute, and a diminution of them a chronic disorder. . . . The manner in which one secretion may be greatly increased, whilst the rest are suppressed, is remarkably illustrated in pestilential cholera. In this malady it would seem as if the efficient cause suppressed the vital manifestations of all other organs, determined the *remaining vital influence* and circulation to the digestive canal, and occasioned an uncommon increase and alteration of its exhalations; the serous portion of the blood being in great part evacuated in this situation, leaving a portion of its albumen lining the intestinal surface in the form of a muco-albuminous and tenacious exhalation."

The foregoing views in reference to the pathology of fever and cholera are confirmed, to some extent, by the phenomena of *syncope*, however induced, whether by physical violence, or the loss of blood, or by any great mental emotion, &c.; as well as by the circumstances under which death ensues, not unfrequently, either on the receipt of some comparatively trifling wound or local injury, or on the occurrence of some passing bodily indisposition, &c.¹

¹ Chavelier many years since described what he considered a rare and fatal disorder, under the name of "Syncopal Asphyxia." The peculiarity of syncopal asphyxia, according to Chavelier, is that the ordinary signs of vitality in the

Young practitioners ought, of all things, to bear in mind the cause and character of that form of *syncope* which is the

body are suddenly either interrupted or cease altogether; that, in fact, it commences, not unfrequently, where other disorders end, viz., *in death*. Chavelier though an acute observer, does not seem to have been aware that syncopal asphyxia is due to some spontaneous shock occurring to the organic nerve-matter; a shock not unlike that which, under certain antecedent circumstances of exposure to *malaria*, and so on, causes fever, or perhaps cholera, so called. When our brave and neglected troops occupied the Crimea in 1855, the fearful mortality which prevailed was, as it appears to me, due to "syncopal asphyxia," first mentioned by Chavelier. The 'Times' report contained these words, viz., "A new and fatal disease has made its appearance here. The cause of death is said to be cholera; *but it appears to be a painless malady, which carries off the victim in an hour or two*. Many persons have lately died of this somewhat mysterious disease, and rumours have spread abroad that the plague has once more visited Constantinople, but that the authorities and doctors do not wish the truth to be known. But this is only one of the reports which the present excited state of men's minds leads them to credit without examination. If there be anything new in the disease, it will probably be found to resemble the fever which carried off the Turks in such numbers at Balaklava. The blackness of the body, *and the suddenness of the death*, seem to denote some connection between the two maladies."

The following paragraph appeared (in 1855) in Dickens's 'Household Words,' viz.:

"*Cold in the East*.—It is bitterly cold—that clammy, deadly cold of these climates, against which no clothes seem able to protect you. It is a cold which is not felt in the chest, nor hands, nor feet, as our cold in Europe is; *but it is sure to strike first at the stomach*. You were well just now, and, trying with all the philosophy at your command to be jovial under difficulties, suddenly you are seized *with agonizing pains just below the chest*. In vain you try to make light of it. You are obliged to lean for support against the first thing or person at hand. Your extremities have become chilled and useless—you sit and double yourself up, hoping something from warmth and quiet; at last you lie down and writhe in the intensity of your pain. If you are driven to take brandy (hot brandy and water is best), you feel a peculiar sickness for some minutes, and then the pain slowly subsides; but it leaves you stupid and depressed for hours afterwards, and trembling and nervous. The only way to give yourself a chance of escape is by winding some twenty yards of silken or woollen sash tightly round your loins and *abdomen*. It is the custom of the country—the dress of the peasant and the prince; and you will soon understand that it has not been

first effect of severe bodily injury. A man is thrown from a horse, and receives, it may be, a heavy blow on the head, or a compound fracture; another falls from the parapet of some house, and is picked up suffering from a broken head, faintish, and scarcely conscious. In these cases the solar ganglion and the organic nervous system, generally, has received so severe a shock that the vital functions are threatened with extinc-

adopted without a reason. This was the commencement of that sickness which carried off numbers of our troops. The doctors called it cholera; *it was only cold.*"

The foregoing extracts are, doubtless, most valuable and interesting.

Some months since, there occurred at Bristol, and in its neighbourhood, several cases of sudden illness, and even *death*. A sudden and alarming *syncope* was the first symptom of the attack, and this was succeeded by nausea, and perhaps vomiting. I experienced an indisposition of the kind, in common with some of my neighbours. It commenced with a peculiar sinking sensation at the pit of the stomach (the epigastric centre), this passed into what seemed a sense of general faintness, the consciousness remaining intact though oppressed. I had just got into bed, and being attacked, therefore, when in the recumbent position, to rise was impossible. Feeling at the time an instinctive desire to eat or drink, I had two or three sandwiches given me, and some sherry wine. However, I became so alarmingly ill, that a medical friend was summoned to my aid; it was not until after some seven or eight ounces of undiluted brandy were taken, that I was expected to recover. The epigastrium was covered over with hot mustard poultices, and other external stimulants employed. Mr. Higginbottom has written recently in the 'Lancet,' on attacks of this kind, which he has termed "Syncope senilis from gastric irritation." Now with regard to the adjective *senilis*; it applies neither to myself, nor to the case of a neighbour who *died* from, as I believe, *syncopal asphyxia*, because neither of *us* can be said to be *old*; and as to the complication of the disorder with "gastric irritation," this cannot, probably, be put down more as a cause than a consequence. Certainly the presence of acrid and indigestible substances, or of offensive gaseous matter within the *primæ viæ*, is well calculated as an *eccentric* affection, to derange and weaken the vital stimulus imparted by the ganglia of the sympathetic to those organs concerned in digestion; nevertheless, we can expect little else, in cases having their *origin* in the ganglia named, and in which *syncope* is the principal feature, but that the stomach and intestines should give some evidences of a corresponding and consecutive disturbance.

tion. The heart and lungs, and the brain, no longer receive their normal and accustomed stimulus; the pulse falters; the respiration is impeded; and the cerebral faculties are without power. The expression of the countenance, the feeble circulation, and the low temperature of the skin express, eloquently enough, the demand for restoratives; whilst they proclaim, in accents of alarm, the great risk of depletion. Truly, patients have been bled in the cold stage of ague, and in other fevers, as well as in the collapse of cholera; also on the receipt of severe bodily injuries; and, what is more, have yet lived to record the fact. Nevertheless is such a practice attended with the greatest risk; and there can be no doubt that, in many instances, patients have been killed by it. A middle-aged man fell from the roof of a house. I saw him in consultation, but not until he had been largely bled from the arm; there had been also a very considerable loss of blood from a wound of the scalp. The poor fellow was sinking fast—nothing like reaction took place; he lingered a few hours, and died. In 1838, I happened to be on a race-course in Hampshire, when one of the riders was thrown when at full speed. He was greatly hurt, and, on my seeing him, was much collapsed, and scarcely sensible. There was very much sympathy expressed for the young man, and I was entreated to bleed him; on refusing so to do, it became evident that my medical services were deemed of no value. Amid much noise and cavil, and after a little time, some signs of improvement took place; reaction followed on the administration of a few table-spoonfuls of wine; and so this scene came to an end. Some eight hours after the accident bleeding was practised with the best effects; as then the ganglia of the sympathetic had recovered their tone, and the heart, lungs, and brain, &c., were again in a position to exercise their several functions in the animal economy.

The advice contained in the few following words, from the pen

of the late Mr. Liston, is so appropriate and of such great value, that I venture to quote it: "I am no advocate for meddlesome surgery; nature well and judiciously assisted will generally bring matters to a speedy and happy conclusion; and ought *not* to be thwarted, tampered and interfered with, as is too often done by those who still try to cure all diseases and injuries by the pure force of surgery."—"A person receives a serious injury of the head, chest, or limbs; he is taken up pale, bleeding, and insensible, and is carried to a practitioner, perhaps an unlicensed one. He expires shortly after, or, it is said, is not expected to recover, notwithstanding he had the most prompt assistance afforded, and was immediately bled. The injured person has, in such circumstances, a much better chance of recovery when let alone for a time, to allow re-establishment of the circulation, than when exposed to such misapplied attentions, and subjected to such unceremonious and ill-judged practice, as abstraction of the vital fluid at so improper a time, when it can be little spared; and when, in fact, the loss of a very trifling quantity will go far to extinguish the small remaining spark of life."

It is on the physiological principle above insisted on that the experienced surgeon avoids, if it be possible, the performance of a surgical operation upon an individual whose general health is impaired—whose ganglionic nerve matter is in no position to give out that amount of "Promethean fire" (stimulation) requisite to the normal condition of the contents of the great cavities of the body—whose vital energies, having lost their tone, are below par. It is but a couple of months since¹ that I saw a case requiring amputation near the shoulder-joint for an extensive and incurable affection of the upper arm. I gave it as my opinion that the limb should be removed—but not until after the poor fellow had had the

¹ This was written in 1845, in Ceylon.

benefit of a good and liberal diet, with wine, &c., for some two or three weeks. However, no delay was allowed—amputation was performed forthwith; the patient lingered on some nine days, and then died. At this time, the cut surfaces presented no more appearance of healing than they did on the completion of the operation. Now, this man's life was, in all probability, sacrificed to the impatience manifested—there was good reason to expect that, had some time been allowed to elapse, and his strength had then improved, the case would have terminated favorably. It is plain enough to be understood that when the organic nervous system is unable to impart a sufficiency of energy to the dependent organism for the due maintenance of its power—surely it is too much to expect that the same can combat against an additional difficulty, as in the case of a capital operation.

Physicians and surgeons engaged in the practice of midwifery are familiar with a “syncope” of a peculiar kind, which occurs subsequently to the birth of the child. If we will be at the trouble to refer to the best authorities on this very interesting subject, it will be seen that the opinions expressed as to its nature and cause are by no means satisfactory. For instance, in the ‘*Outlines of Midwifery*,’ by Dr. Conquest, we read thus: “Syncope, subsequently to delivery, is unconnected with uterine hæmorrhage, for, on opening the body after death, the uterus is found firmly contracted, and consequently not containing an unusual quantity of coagula. Nor is it referable to aneurismal hæmorrhage, or to any organic disease of the heart.” He adds, “Several circumstances combine to produce this fainting, but the principal one seems to be the loss of balance in the circulation in consequence of the sudden removal of pressure from the iliac vessels by the diminution in the bulk of the uterus, which permits the blood to rush to the lower ex-

tremities. This is associated with a corresponding emptying and collapse of the vessels of the brain ; and, as a consequence of this, the action of the heart and arteries is impaired and finally suspended." That *syncope* occurring after delivery is to be referred, in the majority of instances, to "the sudden removal of pressure," there can be, I think, little doubt ; but not that from the "iliac vessels by the diminution in the bulk of the uterus," but from the abdominal viscera. The fact would appear to be this : the emptying of the uterus destroys the long accustomed adaptation or relationship of the contents of the abdominal cavity ; it removes, or rather alters, the bond of union established between the containing and contained parts of the belly. A kind of chronic concussion may be considered to occur to the great organs of the body, by which they are more or less discomfited, and injuriously affected ; the effect is necessarily propagated to the ganglia of the sympathetic through the medium of the ganglionic nerve-matter forming so great a portion of the bulk of the intestinal canal—liver, omentum, pancreas, &c., and hence results the "collapse¹ after labour." (Ramsbotham.)

¹ It does now and then happen that a *fatal* "collapse" occurs *during the progress of child bearing*. A woman who had been some fifty hours in labour, complained of feeling faint ; and the uterine pains, which had been considerable and long continued, became more and more feeble, and less and less frequent, and at length ceased altogether. The collapse went on increasing. Stimulants were given, freely, but to no purpose. I was sent for towards the climax of this sad scene, but arrived *after* the patient's decease. The child was removed by the Cæsarian section. There was no rupture of any kind, either of the uterus or vagina ; the cause of the death, then, must be viewed in connection with the great sympathetic nerve : this had been drawn on in a manner incompatible with its energies. The requirements of the body generally, including the *uterus*, had proved too great for the capacities of the organic nervous system ; and both the *body*, and *it* succumbed to the struggle. The organic nervous system was not only in no position to respond to the demands on it, but fell prostrate, and utterly worn out in the vain struggle or endeavours made to meet the vital necessities of the case.

Every one knows that the too rapid escape of the fluid from the peritoneal cavity in *ascites*, is, now and then, accompanied by alarming depression and faintness. A few weeks since¹ I was required to perform "paracentesis abdominis" on a Cingalese young man. After I had left the house the friends of the patient were induced, at his solicitation, to remove the bandage with which I had enveloped his abdomen. Syncope came on, and the patient was very nearly dying. I am aware that the late Mr. Liston attributes the faintness, in cases of this kind, to "an accumulation of the blood in the branches of the portal veins."² I am, however, confident that the *bona fide* explanation of the fact is to be sought for in the loss of the long accustomed adaptation or relationship between the containing and contained parts of the abdomen; whereby the ganglionic nervous system is, at its very centre, in some way "injuriously affected," *i. e.*, more or less paralysed.

In point of fact, the syncope or collapse which, in some rare cases, occurs to the parturient woman, or attends on the too rapid escape of the fluid in *ascites*, is due not less to physical violence, strictly speaking, than was the death of "John Smith" mentioned in the last chapter. The attendant circumstances are, of course, as unlike each other as they well can be; but the direct or proximate cause of the syncope or death is, or was, in the several instances cited, very analogous.

As to the expressed opinions of Dr. Conquest and Liston, as above mentioned in connection with the syncope occurring after labour, as well as after "paracentesis abdominis," I am reminded that in death from *hæmorrhage* the fatal event is to be referred, *not* so much to the loss of balance in the circulation or to the absence of blood in the

¹ Written in 1845, in Ceylon.

² See Liston's 'Operative Surgery,' 3d edition.

brain, as to the cessation of the circulation through the large and important organs within the chest and abdomen. These are, in great part, made up of ganglionic nerve-tissue, and being in immediate contact with the large ganglia of the sympathetic, lying on either side of the spinal column, in its whole length, their mutual dependence is such that any interruption of the vital processes taking place in the heart, lungs, alimentary apparatus, liver, &c., must directly impair the function of the solar ganglion and its auxiliaries, the said *ganglia of the sympathetic*; and, therefore, it happens that death is consequent not unfrequently on the profuse loss of blood.

We hear from time to time of individuals dying from fatigue (over-exertion)—we know, too, that animals when hotly pursued and taxed beyond their endurance, will drop and die; we have seen instances of sudden death from violent mental emotion, and are acquainted with the names of those great in the histrionic art whose death has supervened on realizing the fancied climax of acute and terrible passion. Patriots have met their end when in the act of defending their country's best interests, and declaiming against its oppressors and enemies; statesmen have felt deeply and earnestly the cause which engaged them, and have thus drawn so tensely the cord which bound them to life, that it has yielded to the hot pressure—snapped e'en whilst it seemed strongest and most enduring. Birds, in their flight over the Atlantic, driven sea-ward by stress of weather, fall dead. What explanation is offered for the above facts? How does the physiologist, or more properly the pathologist, account for them? Disease of the heart, or apoplexy, is said to be the cause of the sudden dissolution, in such instances as the above. This is, as the rule, doubtless quite a mistake; the only sound explanation to be offered is just this: the ganglionic nervous system has been drawn so largely on by the cerebro-spinal

and muscular systems that it has nothing remaining for the internal thoracic and abdominal viscera—no stimulus left for the vital organs.¹ Under such circumstances the heart and arteries have no power to propel the blood onwards in its course; the lungs cannot act as they should, and the necessary chemical changes in the fluids of the body are discontinued. Whilst the whole organism becomes thus imbued with an impure blood, a stream impregnated with deleterious qualities, and abounding with materials of a highly sedative and poisonous nature, the brain, as a part of that organism,

¹ A simple fact will not unfrequently fix an interesting and important physiological principle on the mind more effectually than anything else. A young gentleman came to spend the day with myself and family, during my residence at Ceylon. He happened to be passionately fond of boating; and close to my “compound” (garden), there was an inviting piece of water, boat, &c. Although cautioned against the heat of the weather, the exposure, and the incompatibility of a tropical climate with any very considerable amount of bodily exertion, he persisted in demonstrating his prowess to those who would be lookers on; and dearly he paid for it. On returning to the house he was attacked with severe vomiting, and became so faint and exhausted that some alarm was felt for his safety; however, after an hour or two, he thought himself recovered, and in due time sat down to dinner. But there was neither *appetite* nor *digestion* for him on that day; Shakespeare was invoked in vain, he continued without the “appetite,” and he needed therefore no *digestion to wait on it*; and for the issue of both, viz., health, our friend’s patience was taxed until the morrow. It was not until after a night’s rest that his ganglionic nervous system was in any position to find the necessary stimulus for either the cerebro-spinal system or *the vital organs*. The excesses and extravagance committed by the muscular structures demanded a sacrifice—this made, the necessary balance of the vital forces was resumed; and the brain, muscles, stomach, heart, &c., were again on terms of amity, uniting their endeavours to one common end, viz., the health and happiness of the aforesaid “young gentleman.” The foregoing explains, and on physiological grounds, the reason why an over-worked or hard-ridden horse refuses to take his food; and why, I may add, many a poor fellow, in the Crimea, lay down on the battle field, as well as in the deep trenches before Sebastopol, and there resigned his life to Him who gave it. A blot this, and an indelible one, on the otherwise fair escutcheon of many bearing a proud and honoured name in this great country.

becomes involved in the impending ruin, and all consciousness passes away ; death closes the scene.

In a late number of the 'Medico-Chirurgical Transactions,' there is reported by Mr. Bransby Cooper, a case of alarming *syncope* occurring during the removal of the arm, for malignant disease of the humerus, at the shoulder-joint. The "syncope" is ascribed to the admission of air into the veins during the operation. Mr. B. Cooper argues—and I think very fairly—if from experiments made on the lower classes of animals, it is concluded that not only is it necessary, in bad cases, that a large quantity of air must be admitted into the veins, but that "it must be thrown in with a certain degree of force," it follows that, in such cases, "there must be a certain condition of the patient induced to facilitate the entrance of air, depending partly, perhaps, upon the oppressed, if not suppressed, action of the heart and lungs—the effects of FEAR upon the nervous system ; a state from which the lower animals are comparatively exempt." My own impression is that the alarming syncope in Mr. B. Cooper's patient, "Elizabeth Cousins," depended principally, if not entirely, on the depressing effects of "fear" on the organic nervous system ; whereby the heart and lungs were deprived, in a great measure, of their accustomed stimulus to action, in common with the other organs. It cannot, as it appears to me, be ascribed with any propriety to the admission of air into the veins. It seems very much more likely that the "certain condition induced" in Mr. B. Cooper's patient—"the effects of fear upon the nervous system"—becoming aggravated, realised, in itself, all the phenomena of that *alarming syncope* mentioned by this eminent surgeon—than that any large quantity of air passed into the collapsed veins of the cut surfaces of the wound, and that in "a considerable quantity" and "with

¹ This was written in 1845.

some force :'' it must not be forgotten that both of these conditions are said to be indispensable to the production of any ill effects, from the presence of the atmosphere within the heart and its vessels, on the human subject and animals.

Now the effects of *fear* on Elizabeth Cousins (Mr. B. Cooper's patient) may be, perhaps, described as acute ; and, like all acute affections of the system, were temporary only. The *syncope* was of that urgent character, that had it not been relieved, and that immediately, death must have ensued. Let us, however, suppose that, in the case of E. Cousins, the cause of her great alarm had been of another character, and had not been associated in any way with the amputation of a limb—that, in fact, the cause of her deep affliction had been of a somewhat less intense and less temporary kind—then very likely the effects produced may have been described as chronic, and may therefore have extended over a considerable period. Allow all this, and we shall realise the precise condition of a female admitted into the Hanwell Asylum, in 1842. The young woman alluded to, having lost her husband, had become exposed to various small pecuniary difficulties ; and when experiencing to the full the doubts and disadvantages of her position, added to her responsibilities those of a mother. Her position was, evidently enough, pressing badly on her, but the last drop to her bitter cup of sorrow was yet wanting ; and this was not long to be withheld. The house in which she lodged took fire, and her little all was consumed. Soon after this occurrence it was found necessary to send her to the Asylum at Hanwell. On admission she seemed more like a statue than anything else ; nothing aroused her. The mind and body were alike motiveless and motionless. Sensation, thought, consciousness, moral sense, the passions, one and all seemed to have fled ; the signs of animal life had, to all intents and purposes, ceased ; those of organic life alone remained. From the

period of the accidental fire, the mammary secretion was arrested, and so also was the lochia; or thus I was told. The intestinal and renal secretions were greatly impaired, and she would neither eat nor drink of her own free will. The respiration and the pulse were slow and feeble; skin pallid and of a low temperature; the countenance anxious, and the features retracted. She was greatly emaciated. In this case, as in that of E. Cousins, *fear* was the remote cause of the symptoms of depression (syncope) which were present; the proximate cause of the same, and in both instances, was a severe, even dangerous interruption of the functions exercised by the ganglionic nervous system, or by the many ganglia of the great sympathetic. But in one the disorder was acute, and in the other chronic; and so far corresponded with the *nature* of the antecedent circumstances, and their operation on that portion of the organism just named. In both patients the physical impression made on the ganglionic nervous system was such, that it was rendered, for a definite period, unfit to discharge its normal functions in the animal economy; and hence was it that all the indications of both animal and organic life were so much interrupted.¹

¹ The case mentioned in the text will, not unlikely, remind the reader of those phenomena described as belonging to that peculiar condition of the mind recognised by the term "reverie." To realise the nature of "reverie" it is sufficient, as it appears to myself, to recall that very singular state of feeling, of psychical existence which immediately precedes sleep, and hence it may be named *a conscious* (involuntary) *dreaming*. However, *reverie*, may be either normal or abnormal, *i. e.*, may occur in the most natural and spontaneous manner, or owe its existence to some sufficient cause of disease, *i. e.*, to fear, or some other corresponding, and violent emotion. A consideration then of the two forms of *reverie* may help us to an explanation not only of the *physiology* of the one, but to that of the *pathology* of the other. The progress from wakefulness to sound repose is marked by a gradual extinction of cerebro-spinal life; or, in other words, by a slow, yet sure withdrawal of the bulk of the ganglionic nervous influence from the brain and spinal cord. Now this said "extinction" or "withdrawal" may be, and is, from time to time arrested at

How often does it happen that on the occasion of certain individuals being attacked with disease, and becoming

some certain point; *i. e.*, instead of being continued to its natural climax, is checked in its onward course to completion. When this happens the individual may be described as in a *reverie*, or a state of sleep-waking. We will imagine the antecedents of another kind, or *abnormal*; an individual, for example sake, is exposed to some alarming casualty, in short he falls off a precipice, or into the water, or his feelings sustain some terrible shock; the same *reverie* occurs, the cerebro-spinal system is no longer supplied with its normal *quality* or *quantity* of ganglionic nervous influence, and disease, of a specific kind, is set up in the system.

Further, if the *temporary reverie* which precedes the sound sleep of a healthy man were protracted, or became permanent, it would be regarded as a *disease* (a disease, too, which continuing might prove fatal); and its nature would be the more readily appreciated, if by any chance such a person had happened to be exposed to any violent mental emotion, thereby giving another and unfavorable character to its *antecedents*.

It is too much the custom to look on all those *shocks* to the nervous system which are *not* of a really palpable and *material* nature, as of comparatively little moment, and as unlikely to be attended with any very fearful or mortal consequences; this is a great mistake. Mental suffering and bodily pain are more closely allied than many think them to be—they are equally real, and, what is more, *material*. Our ignorance has, hitherto, blinded us to their anatomical identity; but this is not the place to dwell on this fact. I would add here, that the *shocks* alluded to, though they may and do manifest their effects to some extent through the medium of the cerebro-spinal system, have their origin, more or less directly, in the organic system of nerves. This is proved, in an especial manner, by reference to extreme cases; by, in fact, fatal cases. The annexed case presents a few especial features, and a general complexion, which induce one to refer the variety, and not less the intensity of the symptoms to the ganglia of the great sympathetic nerve: it is copied from the columns of the 'Times.'

"*Personating a Ghost*.—A long investigation took place at Greenhill Lane, near Alfreton, on Monday afternoon, before Mr. Busby, one of the coroners for Derbyshire, touching the death of Robert Mitchell, agricultural labourer, aged fifteen years, the son of Joseph Mitchell, who died on Friday evening last from the effects of fright. The deceased was a healthy, intelligent lad, and used to work with his father in the fields. He had been in the habit each night for about a fortnight past, after leaving his work at five o'clock in the evening, to go from Mrs. Flint's, where he and his parents lodged, to the farmhouse of Mr. Day, at Roby Fields, near Alfreton, for milk. The deceased and his father

alarmed for the result, they are observed not only to suffer an aggravation of their symptoms, but almost to anticipate

worked for Mr. Day in draining the land. Mr. Day had two servant lads, one named John Percival, about twenty years of age, and the other Isaac Hudson, fifteen years of age. On Monday evening, the 15th inst., about a quarter to six o'clock, Robert Mitchell, the deceased, came as usual for the milk, and remained till between seven and eight o'clock. Mr. and Mrs. Day, Percival, Hudson, and the deceased were the only persons in the house, and telling tales about some knocks that they had been frightened with. Percival and Hudson arranged together, unknown to the deceased, that they should play the ghost. It was agreed that Percival should take a white table-cloth and put it over him, and stand in a close not far from the house, and Hudson was to conduct the deceased to the place, and pretend to be frightened when he (Hudson) saw Percival with the sheet on. About half-past seven o'clock, Percival called Hudson out and said he was ready. He had a white tablecloth under his arm, and he told Hudson to follow him with the deceased shortly after. In about ten minutes or a quarter of an hour after this Hudson took the deceased out of Mr. Day's house, and Hudson told the deceased that he would go with him to Mrs. Flint's, where he lodged. They went together along the footpath across the field in that direction. After they had got about 120 yards from Day's house Hudson saw Percival with the tablecloth over him. Hudson said 'Look, Robert, what's that?' Deceased said 'Nothing, come along.' Percival, 'the ghost,' was then about forty yards from them. Hudson and deceased then went on further, until they came within seven or eight yards of the ghost. Hudson feigned a scream, and the ghost was standing by the stile which they had to pass through. The 'ghost' then moved about a yard and a half behind the stile. Deceased stood still and said 'Jack.' There was no answer, and Hudson ran and hid himself behind a tree in the hedge. Deceased went up to the stile and called 'Jack' a second time. There was no answer, and deceased went through the stile, when Percival made a noise like a moan. Hudson was only ten or twelve yards off. Hudson then heard deceased say 'Is it Jack?' and there was another moan; but afterwards Percival threw off his disguise, but the deceased was much terrified, and went home and arrived there about eight o'clock with the milk. He was 'all of a tremble,' looked white, and stared wildly, and on being interrogated by his father, related what had occurred, though he did not believe it was the servant-man Percival, and he could not account how he got home. Deceased ate nothing that night and went to bed, and to his work next day, but he was seized with vomiting, and was obliged to be conveyed home, and complained of a pain in his throat. The deceased grew worse, and raved in his bed about what had happened, and he died on Friday evening. Mr. Belcher, surgeon,

the fatal termination so much dreaded. Such patients are not only troublesome, but difficult to treat; that many such

attended the deceased, who, he said, was suffering from extreme nervous excitement. He believed death to have resulted from exhaustion occasioned by a shock on the nervous system which he had received on the previous Monday evening. The coroner told the jury that they must be satisfied that the death arose from fright, and, if so, whether it was a frolic in which all the boys were parties. If it arose from fright, the frightening was unlawful, and Percival would be responsible. After some deliberation, the jury returned a verdict of 'Manslaughter' against Percival, who was committed to the assizes."

Not unlike the preceding case, is the following, taken from Macnish's 'Philosophy of Sleep': "George Groatzhi, a Polish soldier, deserted from his regiment in the harvest, of the year 1677. He was discovered, a few days after, drinking and making merry in a common ale-house. The moment he was apprehended, he was so much terrified that he gave a loud shriek, and was immediately deprived of the power of speech. When brought to a court-martial, it was impossible to make him articulate a word; nay, he then became as immoveable as a statue, and appeared not to be conscious of anything that was going forward. In the prison, to which he was conducted, he neither ate nor drank. The officers and priests at first threatened him, and afterwards endeavoured to soothe and calm him, but all their efforts were in vain. He remained senseless and immoveable. His irons were struck off, and he was taken out of prison, but he did not move. Twenty days and nights were passed in this way, during which he took no kind of nourishment; he then gradually sank, and died."

Mr. Dunn, of London, has recorded an interesting example of *shock* to the ganglionic nervous system. A female, of a highly excitable temperament, stumbled when walking on a pathway close to a river side, and falling into the water was very nearly drowned. She suffered for some days after from general indisposition, to which a "fit" succeeded; from this fit (*hysteric coma*) she only partially recovered, inasmuch as her mental faculties continued "benumbed or paralysed." She appeared to have lost her memory; the external senses were also impaired. This peculiar cerebro-spinal inaction or incapacity lasted one whole year, at the expiration of which time it ("reverie") was abruptly terminated. The consciousness would seem to have been from time to time, and to a certain extent, intact, during the continuance of this peculiar disorder; at any rate, the issue proves that the patient waited only the occurrence of a powerful stimulus (emotion), to dissolve the hitherto too stubborn charm which prostrated her. "One day," writes Mr. Dunn, "she witnessed a scene which gave her system such a sudden and violent shock, that she fell down in a

die through *fear*, as much as from disease, scarcely admits of doubt. Certainly, in some constitutions, and under pecu-

fit, and remained many hours in a state of insensibility. It is described as resembling the first fit, with which she was attacked when she lost her senses. It proved critical and sanitary. When the insensibility passed off, she was no longer spell-bound. The veil of oblivion was withdrawn, and, as if awakening from a sleep of twelve months' duration, she found herself surrounded by her grandfather, grandmother, and other familiar friends and acquaintances, in the old house at Shoreham. She awoke in the possession of her natural faculties and former knowledge, but without the slightest remembrance of anything which had taken place in the interval from the invasion of the first fit up to the present time."

Mr. Dunn's case, then, unlike the two former, terminated in the *recovery* of the patient. Robert Mitchell and George Grokatzhi sustained so severe a *shock*, that not only were the mere animal functions placed in a state of abeyance, but also those appertaining to organic life: the morbid impression brought to bear on them was so acute that the cerebro-spinal functions, *and* those essential to the *life* of the individual, succumbed—the parties named died; the one after some hours, the other in a few days. These were doubtless, exceptions to the general rule, "in which the sensorial energy is such as apparently to exhaust the entire stock, except, indeed, the reserve which is in almost all cases instinctively kept back for the use of the *vital* or *involuntary* organs." (Good.) The restoration to health of Mr. Dunn's patient was due to the morbid phenomena being restricted in a great measure to the animal functions, in so far as these are performed by the brain and cord, *i. e.*, to the outworks of the citadel; to the exclusion, in great part, of the citadel itself.

I would submit, for the consideration of Mr. Dunn, whether or not the "extensive abnormal innervation" mentioned by him had, in point of fact, its *origin* and *seat* in the ganglionic nervous system, and *not* in the "cerebral hemispheres;" and that the palpable condition of these (as indicated by the "psychical phenomena" presented to his attention) constituted only an effect or outward sign or symptom of the said "extensive abnormal innervation" existing *centrically*. Certainly Mr. Dunn has erred in giving the prominence he has to Dr. Carpenter's view of the gray matter forming the floors of the lateral ventricles. This *gray matter* may be, and probably is, the medium or bond of union, the connecting psychical link between the spinal cord and the brain, *i. e.*, between the "sensation and locomotion," and the strictly mental powers—those intellectual and emotional; but to believe, at this day, that the "thalami optici" are the seat of the emotional feelings, of anger, love, veneration, pride, love of approbation, attachment, &c., is to draw down on us the contumely of

liar circumstances, a comparatively trifling disorder or accident will shorten life ; patients will, every now and then,

our successors. Drs. Carpenter and Noble command my best respects ; however, it is impossible I can forget those due to an illustrious predecessor, I mean Gall. Drs. Carpenter and Noble ignore *phrenology* ; these gentlemen are bound to obey, and they do obey, the impulses springing from their organization ; and hence the tone and tendency of their writings, *i. e.* their anti-phrenological tendencies.

It does not appear that Mr. Dunn was aware when he drew up his interesting case of what I would call “revery,” that Good, in his ‘Study of Medicine,’ has described the disease as resulting in a general way from either too little or too much *attention*. By Good *revery* is divided into three species of mental aberration, viz. :

Aphelxia socors	.	.	.	.	Absence of mind.
„ intenta	.	.	.	.	Abstraction of mind.
„ otiosa	.	.	.	.	Brown study.

“In the first of these, the *attention* is truant, and does not yield readily to the dictates of the will ; in the second, *it is riveted at the instigation of the will itself to some particular theme unconnected with surrounding objects* ; and, in the third, it has the consent of the will to relax itself, and give play to whatever trains of ideas are uppermost, or most vivacious in the sensory.” Mr. Dunn’s case comes, I believe, under the second definition, inasmuch as it was brought about by “overwhelming passion” (emotion) (Good) ; and the *attention* seemed, to say the least of it, riveted to “some particular theme unconnected with surrounding objects.”

Several cases of “reverie” have come under my own notice : A young woman took a large quantity of nitrate of potash, with the hope of procuring miscarriage. Severe and painful vomiting followed, and the poison was got rid of. Diluents, and afterwards full doses of acetate of morphia, were prescribed for the relief of *pain* and acute nervous symptoms ; and the *prima via* in its whole length was effectually emptied. Some symptoms of abdominal inflammation came on, but these were met by the application of leeches, &c. On the fifth day from that on which the *nitrate of potash* was taken, she fell into so decided a *reverie* that there was no doing anything with her. As in Mr. Dunn’s patient, the “mental faculties” of this young woman “were quite benumbed or paralysed ;” *memory*, and *the power of associating ideas, she had lost ; she could neither smell nor taste, speak nor hear*. Whether or not she retained her “sensibility to touch,” and her sight, I am uncertain. The paroxysm lasted four days.

In 1853, J. H— was placed under my care, suffering from *melancholia*, caused

slip through one's fingers, before the medical attendant can well be prepared for such an event. The ganglionic nervous

by severe domestic affliction. He soon began to improve, and hopes were entertained of his restoration. However, he fell, by slow degrees, into a passive state of existence, losing, apparently, all care and anxiety, and desirous only to be left altogether alone and to himself. This state of things passed from bad to worse, in spite of much attention and careful and discriminating treatment; and, at length, J. H— would neither move, speak, nor take nourishment of any kind. In fact, he became to all intents and purposes a mere inanimate object; he seemed stubbornly to ignore all and everything appertaining to the external world. He was managed as an infant, dressed and undressed, &c., his food being administered to him through a kind of funnel-shaped instrument with an œsophageal tube attached. It is almost needless to add, that the contents of the bladder and rectum passed from him as he lay. During this "reverie" the countenance betokened much sensorial action (emotion); but this was, to all appearances, *monomaniacal* in its nature and tendency. This poor man's thoughts were, so far as one could judge, "riveted to some one particular theme unconnected with surrounding objects," to quote yet once again the words of Dr. Mason Good. The paroxysm may be said to have terminated some few hours before he died; when he sat up, asked the attendant near him for pen, ink, and paper, and after some protracted preparations, begged to be assisted out of bed. Seating himself at a small table, he wrote with great care a short note to his wife; having done so, he drank a little wine and water, and in a few hours more he was a corpse.

At the moment I write, I have a gentleman under treatment, who has been in a continued *reverie* for a very long period; but this case is of a partial character, when compared with that last mentioned. However, he has not spoken for some six years, with but *one* very trifling exception; and, if he were left to himself, he would, probably, become as much a fixture as a door-post or a book-shelf. At the Hanwell Asylum there were two similar cases, in 1844; and one such was admitted at the sister asylum at Colney Hatch, during my official residence there, in 1851.

I have seen persons, when under the influence of animal magnetism (mesmerism), present the external features or characters of *revery*; but, inasmuch as these were induced artificially, and were the effects of a cause of a fleeting and temporary character, they passed, quickly, away.

Revery, or "aphelxia intenta" (Good), may be and is sometimes complicated with hysteria, or catalepsy, or convulsive disorder, of some kind; this was the fact in Mr. Dunn's patient, in whom fits of "spasmodic rigidity" and "insensibility" occurred.

system is, in some cases, predisposed to receive a fatal shock from even a small casualty, and it is well, therefore, to be prepared. A small carbuncle, or a slight attack of erysipelas, and such-like, occurring to an unhealthy and lymphatic subject, will not unfrequently cause death, and especially so when the suffering party happens to be of a timid and apprehensive nature. The following case is to the point, and is both interesting and instructive, viz. :

A gentleman, æt. 55, of lymphatic temperament, on returning home at night from a dinner party, found himself unable to void the contents of the bladder. Having been for a long number of years subject to attacks of this kind, he was well provided with catheters, and proceeded at once to introduce one. He made very many attempts, and after waiting some five or six hours in vain, and failing to pass an instrument through the urethra, he sent for me. I found him suffering much pain, and very alarmed by the occurrence of rather a profuse hæmorrhage, induced by his injudicious efforts to push the catheter through the stricture. The urethra was so painful, and in such a state of spasm, that I contented myself by giving a large dose of Tr. Opii, and with the use of the hot bath. The remedies were perfectly successful; the urine flowed freely and copiously *per vias naturales*, a few minutes after my patient got into the bath, and about twenty minutes after taking the laudanum. A smart aperient was administered, and after some hours he appeared well, the parts concerned having re-acquired the power to execute their normal functions. In the afternoon of the next day, my attention was directed to a painful inflammatory swelling on the nates, close to and on the right side of the *anus*, and to which leeches and hot fomentations were directly applied. These were repeated the next morning, the inflammation having extended itself, and, in fact,

involved some portion of the right buttock ; slight febrile symptoms existed. On the fourth day, in the evening, my patient was incoherent, the countenance anxious, and the pulse quick, feeble, and intermitting. Wine, &c., failed to support the *vis vitæ*: he sank, and died at half-past ten o'clock the following morning. As his death, in the minds of his medical and other friends, could not be associated with the comparatively unimportant abscess in progress on his nates, it was confidently, and with much injustice to myself, asserted that he had died from "effusion of urine." I need hardly remind the surgical practitioner conversant with the anatomical arrangement of the pelvic and perineal fasciæ, that the inflammatory swelling above mentioned, about the anus, could *not* have resulted from effused urine ; but must be regarded rather as the *cause* of the temporary *retention*, when in its progress towards the surface of the body.

The very evident influence which the organic nerves exercise over nutrition and secretion, or, which is much the same thing, the marked dependence of the capillary circulation on the ganglionic system, enables us to understand why, in many cases of disease, reputed inflammatory, as in some forms of erysipelas and ophthalmia, for instance, the employment of tonics and stimulants is attended with such marked remedial effects. It also explains to us, not only the *nature* of æsthenic inflammatory action, but puts it in our power both to offer a more decisive diagnosis and prognosis than we could otherwise do ; and to make a more judicious selection of remedies.

In Mr. Lee's work, before quoted, the following observations occur : "Alterations in the quantity and chemical composition of the different secretions, it is well known, may depend upon the influence of the nervous system and of an altered condition of the blood, either occurring from morbid

causes or from the introduction of particular substances into the circulation, of which the flow of tears from mental emotion, the change in the urine of hysterical patients, increased alkalinity of this secretion from injury or disease of the nervous centres, the calcareous concretion deposited in the joints of gouty persons, may be mentioned as familiar examples; but the agency of the organic nerves in producing these changes, both in the blood and secretions, and in inducing various diseased states, is not in general sufficiently considered. Scirrhus tumours, for example, are not unfrequently caused by depressing emotions, as grief, anxiety, &c., acting primarily upon the cerebro-spinal system, and consecutively upon the capillary vessels of the part; so, in like manner, indurations of viscera and other local functional and structural changes of organs may be induced by derangement of the functions, or by direct lesion of the sympathetic or organic nerves, which, united by numerous inosculations with those of the cerebro-spinal system, extend their influence to all parts of the body, and which have been proved, by the experiments of M. Brachet, to preside over the action of the capillary vessels, and of the functions of nutrition and secretion. An abnormal condition of the organic nervous system, or part of it, frequently depends upon alteration of the quantity or the quality of the blood by which it is nourished; and when this is the case, it does not fail to react upon and increase the disordered condition of the vascular system. When, several years ago, it was observed that a section or mechanical lesion of the branch of the fifth pair of nerves supplying the eye produced increased vascularity, with subsequent sloughing of the cornea, acute inflammation was supposed to have been produced by the experiment, and to have given rise to this result. A similar effect, however, was subsequently found to ensue in animals which were fed upon sugar or other substances in too concentrated a state to afford them proper

nourishment; and M. Brachet clearly demonstrated that the circumstance did not depend upon inflammation, but simply upon mechanical distension and consequent obstruction of the circulation through the capillary vessels, from their privation of nervous energy. He observes—‘Let us remember that the ganglionic nervous system presides over the secretions and capillary circulation. When, therefore, in consequence of lesion of the ganglionic nerves of an organ, its secretory and capillary actions are paralysed, it does not cease on that account to receive blood, as this fluid is forced into the vessels by the contraction of the heart; but no longer finding in the capillaries the energy necessary for their reaction, it gradually distends them, and remains almost in a state of stagnation, puffs up (*boursouffle*) the parts where the textures are sufficiently lax to admit of it, and determines redness and swelling, as in the conjunctiva.’ (‘Du System Nerveux Ganglionaire.’)

“Hence we may see that various states which have been considered as inflammatory are not so, but depend upon impaired nervous energy; and why depleting measures would be prejudicial, while those calculated to give tone to the nervous system would be most successful; why the spleen should be so frequently congested after attacks of intermittents, while the more dense texture of the liver is comparatively seldom affected, and why quinine tends to reduce the splenic enlargement; why the congested state of the vessels of the eye, in that state which is termed strumous ophthalmia, should continue so long without producing serious injury; and why, though the local abstraction of blood may occasionally be of service in relieving the congestion, its too frequent repetition predisposes to relapses, which are best prevented, and a cure most permanently effected, by tonic remedies and local stimulants, which strengthen the system generally, and excite the torpid and relaxed vessels to action.

Chilblain is another illustration of the same principle; congestion taking place in parts of the body remote from the centre of circulation, when their nervous energy has been depressed by cold. Dropsical effusions also very frequently occur in the same manner, the serum of the blood transuding through the capillaries into parts where the cellular texture is lax, and whence the blood meets with obstacles in returning to the heart. Softening of the nervous centres and paralysis doubtless occur not unfrequently from the same cause, viz., deficiency of nutrition of their substance, from the nervous energy of the capillaries being impaired, as is pretty evident by these diseases most generally occurring in elderly persons, and those in whom the vital powers have become depressed. I have met with several cases of paralysis consequent upon excesses, from the influence of malaria, &c., or occurring idiosyncratically, in which the too indiscriminate use of blood-letting, and other depleting measures, had been extremely prejudicial, and in which the subsequent use of a tonic regimen had been productive of the highest benefit. That a diminution of the organic nervous influence of the capillaries of the nervous centres is frequently the cause of congestion and its consequences, is clearly shown by an experiment of Brachet. After removal of the upper cervical ganglion in a dog, the eyes became red and tumefied, coma supervened, and after the animal's death the capillaries of the brain and its membranes were found to be gorged to the utmost with blood; on which Brachet justly remarks—'Hence many diseases, apparently of the brain, have, in fact, a very different origin. Suppose the occurrence of an analogous instance to the above-mentioned experiment. Symptoms of disease of the brain take place, the post-mortem examination demonstrates pathological alterations in this organ, the consequences seem to be natural, and yet it is nothing of the kind; *the brain has only become diseased*

secondarily, the organ truly affected is the ganglionic system, the action of which being paralysed produced the phenomena which the brain presented. If the diminution or the abstraction of the influence of the ganglionic system could so frequently occasion the phenomena observed in the preceding experiment, may we not reasonably infer that the same thing will take place whenever this influence is modified by any pathological affection of the upper part of the ganglionic system?" "

The following fact is interesting when regarded in connection with the above observations. Some years ago¹ I was consulted respecting a youth, about 14, who had been under the care of different medical men for "chronic bronchitis," and from which he had suffered for two years. The disease was well marked. Among other things, I directed a blister to be applied to the sternum. The one obtained was much too large, and by some means or the other slipped about both the chest and the abdomen during sleep, in such a way as to vesicate pretty nearly the whole front part of the body. Absorption of the cantharides took place, and he became literally poisoned by it. The ill effects lasted some days, but the bronchial affection became directly relieved to a surprising degree. Under the use of quinine in solution with acid S. dil., and a generous diet, he got quite well, and so he remained. I have since used, in some cases of chronic bronchitis, a mixture composed of quinine, acid S. dil. vin, ipecacuanhæ, and cantharides (tincture), with marked good effect.

If the *health* of an individual result from the balance of all the vital forces, it follows that disease must be the consequence of the loss of such a balance or mutual dependence. The brain, the spinal and ganglionic nervous systems, the nutritive, respiratory, and circulatory sys-

¹ This was written in 1845.

tems, the osseous and muscular systems, &c., stand in much the same relation to each other, and preserve a similar mutual dependence, as the several links of a chain; or as the various parts of a complicated piece of machinery. The same principle of reciprocity of course obtains in reference to the several elements of any *one* portion of our organism. When treating of the nature of inflammation, Müller writes thus: "The intimate reciprocity of action which exists between all parts of the organism, especially through the medium of the nervous system, produces in animal bodies a kind of balance of the forces, whence it results that an existing cause of disease acting on one part, by changing the state of the ponderable and imponderable matters in it, often exerts its influence through a series of such changes on distant parts, which are most susceptible of this form of disease." He adds—"Not merely does the withdrawal of matters at one point prevent the accumulation of similar or different matters at another spot, on which is founded the use of evacuating means at parts of the body distant from the disease, but the increase of vital action in one organ excites many others; hence the connection of the increased vital action in the genital organs with the reproduction of the antlers in the stag, and with changes in many organs in man, which changes, both in the stag and in man, are prevented by castration. The application of renovating stimuli also, to one part, has a vivifying influence on the whole system, reacting from the skin, for example, on the central organs of the nervous system, through the medium of the nerves; whence arises the successful use of frictions and other stimulants to the skin, for the restoration of suspended animation."

If the *principle*, which the foregoing observations of Professor Müller inculcate, be kept in view by the patho-

logist, he will, I think, find in it a very satisfactory clue to the elucidation of many morbid states of the body.

Before proceeding to apply the above *principle*, and to illustrate it, so far as lies in my power, by references to various forms of disease, I must take this opportunity to remark, that up to the present time we are tortured with so great a variety of *names* for the many disordered states of the body, that it is to be feared, that not unfrequently, the object of the practitioner is rather to decide on a *name*, than to understand the precise pathological phenomena which present themselves in his patient. Not only is such a proceeding decidedly unphilosophical, but it is attended with this result, viz., *it leads to a mere routine treatment*. Everybody knows that a prominent symptom in a case, very commonly determines the appellation or title which is employed in medical parlance: thus, if a patient be affected with an excessive renal secretion, he is said to be suffering from diabetes; and so on, of fever, dysentery, anæmia, dyspepsia, apoplexy, asthma, hooping-cough, hydrophobia, &c., &c.,—terms these of great convenience, but sometimes, it may be, but stumbling-blocks for the idle.

APOPLEXY

Is said generally to be caused by the rupture of a vessel within the cranium, and the consequent *effusion of blood on the brain*. It is not so well known, that now and then it happens that cases of apoplexy, terminating fatally occur, wherein not the slightest portion of blood is so effused. I have myself met with two satisfactory instances of the kind; they happened to insane persons—inmates of the Hanwell Asylum. Dr. Cooke, in his ‘Lectures on

Nervous Diseases,' says: "Both Drs. Baillie and Carlisle assert, that examples of apoplexy frequently occur, where no appearance of rupture or effusion is to be discovered." The fact insisted on is highly important, and bears directly on the pathological views here advocated, as will be directly seen.

Dr. Cooke proceeds: "Forestus, Portal, and others, are of opinion, that there may be apoplexy without stertor:" indeed, they make the distinction between the *apoplexia levis* and *fortis*, by its absence or presence.

Dr. Kirkland speaks of apoplexy, "in which there is an immediate extinction of the vital principle, without stertorous breathing."

It is an old opinion, and, I have no doubt, a *truthful* one, that the *immediate* or *proximate* cause of apoplexy may be "*an obstruction of the passage of the nervous fluid into the organs of sense and motion,*" and other parts. Dr. Cullen says: "the proximate source of this disease—apoplexy—may be in general whatever interrupts the motion of the nervous power from the brain to the muscles of voluntary motion; or, in so far as sense is affected, whatever interrupts the motion of the nervous power from the sentient extremities of the nerves to the brain. Such an interruption of the motions of the nervous power, may be occasioned either by some compression of the origin of the nerves, or by something destroying the mobility of the nervous powers. M. Boucher speaks of apoplexy being caused by "a diminution, or defect of secretion of the nervous fluid."

That *apoplexy* is more frequently than otherwise caused by the rupture of a blood-vessel, in contact with the cerebral substance, there can be no doubt; and that, therefore, the mental and spinal functions are very seriously impaired; the vital actions of those organs which are sup-

plied with nerves from the great solar plexus, being much affected, as a consequence. However in other, and less common, cases of the disease, the organic nervous apparatus is *primarily* affected. The nervous fluid or power secreted by the solar ganglion, and the several ganglia of the sympathetic, being no longer conveyed in proper quantity and quality to the brain (principally), and to the other parts of the body, "*apoplexia levis*" is developed. In severe cases, where the deprivation of the organic nervous influence is sudden and complete, death is, of course, immediate; but in attacks of a less violent character, the patient is found with a cold skin, a small and feeble pulse, a retracted and anxious countenance, dilated pupils, and with a sonorous (not really stertorous) and difficult breathing. The heart is, in such a case, oppressed with blood it cannot get rid of, and the lungs are, necessarily, much congested. If the organic nervous influence be not quickly restored, the sufferer must die of *suffocation*.

Any one who has witnessed an ordinary death-bed scene will directly see the parallel between it and the form of apoplexy now considered; the difference of the two cases consists in just this:—in the one the "nervous fluid," or "nervous power," may be restored, in the other it cannot. Whilst in the one the mere physical conditions of life may be said to exist, in the other they have departed.

It may be observed that the state of *asphyxia* which ushers in the apoplexy which commences in the ganglionic nervous system, *succeeds* rather to the other symptoms of the disease in those cases where the cause is located in the brain, and consists in the rupture of some vessel, and the consequent escape of a quantity of blood.

Dr. Marshall Hall, in his 'Lectures on Nervous Diseases,' before referred to, teaches that in apoplexy he is in the habit of predicating the extent of the disease by the condition of

the sphincters. If the sphincters are affected either by spasm or loss of power (paralysis), he infers that the disease involves the spinal as well as the cerebral system. This fact is an important one, and applies with great force to *cerebral apoplexy*; that is, to the attack commencing within the cranium, but in so far as the other form of disease is concerned, where the affection originates in some morbid action involving the vital class of nerves, the same, though of much practical value, must be looked on from another point of view.

A female patient at Hanwell day attacked (1842) with *ganglionic apoplexy* (*apoplexia levis*). I pointed the case out as such to my friend and colleague, Dr. Begley, as well as to the late Dr. Bowden, who was visiting the establishment. The woman died, and my diagnosis was verified. There was no effusion of blood in contact with the brain, no sign of cerebral lesion.¹ The preceding observations in reference to apoplexy, confirm, in many particulars, the views already

¹ The following is an extract from Dr. Copland's work 'On Palsy and Apoplexy.'

"Cases of apoplexy, in which *no morbid appearance* could be detected after death, have been recorded by Willis, Stark, Powell, and Abercrombie; and similar cases have occurred to Morgagni, Tissot, Quavin, Ozana^{aw}, Foderé, and Hildenbrand. Nicolai referred it to spasm of the meninges; Lecat and Weikard to spasm of the nerves and vessels of the brain. Borsieri termed it convulsive apoplexy; and Tissot, and some others, hysteric apoplexy. Hildenbrand conceives that it is the cause of death in contagious typhus; patients dying after profound coma in this disease, without any effusion or appearance of congestion or compression, but apparently from a sudden collapse of the nervous energy of the brain. Apoplectic seizures, rapidly terminating in death, have been occasionally observed to occur in *epileptics* and *maniacs*, as recorded by Foderé, Nucquart, Belloc, and Gendrin, without any manifest lesion of the encephalon." — "A case occurred to me of this description, in a man aged about forty, who had complained of vertigo, leipothymia, and loss of recollection, suddenly followed by profound stupor. He had been blooded largely when I saw him. His breathing was not stertorous; his pulse was weak, small, and quick, and his

quoted from Muller. The great nervous centres of the body, and not less their dependent ramifications, do not bear to be

countenance sunk. The brain, on careful examination, presented no change in colour or consistence, and was even less vascular than usual!"

* * * * *

When treating of "the pathological states constituting apoplexy." Dr. Copland thinks it proper "to premise that the circulation of the brain, like that of other important organs, is chiefly under the dominion of that portion of the organic or ganglial system of nerves which is ramified on its blood-vessels, and is distributed otherwise to the organ itself; and that an exhausted or morbidly depressed state of the influence those nerves exert on the circulation and manifestations of the brain, with the consequent effect this state has upon the capillaries, particularly in dilating or congesting them, or altering their nutrition and organization, and disposing to their rupture, or, to the escape of a portion of their fluid contents, is the principal cause of, and often constitutes the apoplectic seizure, whether this influence emanate from the chief centre of this system, or from the local and especial sources, provided for the peculiar offices of the organ, as the pineal and pituitary glands."

* * * * *

"From this it may be inferred, that the proximate cause of a large proportion of the cases of apoplexy, not omitting even those which are attended with retarded circulation, and hæmorrhage, is here imputed, *primarily*, to the condition of that part of the ganglial system which supplies the blood-vessels of the brain, and the brain itself."

Again—"There are cases of apoplexy that present the phenomena, which have given rise to the appellation of *weak* or *nervous apoplexy*, and which occur from *depressing causes*, operating upon exhausted states of the encephalon and frame generally. These causes directly suppress or abolish the vital influence of the organic or ganglial nerves of the brain; and, consequently, the cerebral functions, without producing further change of its vascular system than retarded circulation, in so slight a degree, as not to amount to great distension and compression, and without occasioning extravasation of blood, although extravasation often does supervene on this state, giving rise to pressure and its consequences; so as to heighten or prolong the primary lesion, and to occasion paralysis, or the ingravescent form of apoplexy, or the form associated with palsy."—"In cases proceeding from *depressing causes*, acting on a plethoric habit of body, the effect is also more or less directly produced on the organic nerves of the brain; whereby the capillaries lose their tone, are congested and dilated, or ultimately ruptured, and the return of blood by the veins retarded, whilst the smaller arteries and capillaries are more and more engorged by the impetus of the blood in the

isolated, the integrity of each one is necessary to the well-being of the remaining two. But the close and intimate relationships between the ganglionic nervous system and the cerebro-spinal is well shown by the experiments of Volkmann, mentioned by Dr. Baly. Volkmann found that by irritating the intestines and the organs supplied by the sympathetic nerve, he gave rise to very extensive reflex movements of the head and trunk. Muller, too, on this principle, explains the occurrence of "cramps" in affections of the viscera. He says, "great irritation of the sympathetic nerves in the intestinal canal, being propagated to the central organs of the nervous system, gives rise to secondary general cramps. It is thus," he adds, "that we must explain the cramps which attend sporadic cholera, and the intestinal affections of children." In the article "Tetanus," in Cooper's 'Surgical Dictionary,' we read, "Mr. Abernethy expresses his conviction, that in tetanus and *all nervous affections*, it is a most material point to operate on the brain through the medium of the digestive organs; and that the production of secretions from the alimentary canal has a more beneficial effect than other means." But I will not anticipate the remarks I have to make in the next chapter, on the treatment of disease. Apoplexy and epilepsy pass by insensible gradations into each other; and the latter may be, I think, considered as an *apoplexy*, in which the excito-motory, or true spinal functions, are more palpably affected. Hydrophobia, tetanus, delirium tremens, hysteria, chorea, including some forms of paralysis, and particularly that common to the insane, are,

large arteries, the pressure thereby occasioned suppressing the cerebral functions as in the other cases." The reader will be pleased to bear in mind that my own remarks on *apoplexy* were penned in 1845, whilst the work of Dr. Copland, from which the above extracts are taken, was published in 1850: these facts are here stated because they afford me an apology for thus falling back at this time on so high and distinguished an authority.

doubtless, more nearly allied than has been hitherto considered. That the external signs or symptoms of the several disordered conditions named, are very properly referred to the cerebro-spinal organism, is most true; but the *integrity* of this structure (cerebro-spinal organism) is, without doubt, dependent on the normal condition of the organic nervous system; and if so, it must follow that the various diseased conditions of the same structure, call them by whatsoever names we may, are to a very great extent referable to it, *i. e.*, the organic nervous system.

Dr. M. Hall has very aptly remarked, "The ganglionic system is that power under which all formation, all nutrition, all absorption, and all secretion are performed, therefore that being affected, may affect these different acts." Truly the ganglionic system being affected, we should expect, *a priori*, that the vital acts named and occurring both to the brain and spinal cord, would become greatly altered from their original and healthy conditions; and, moreover, that such a state of things would, ere long, be made manifest by certain external signs and symptoms—by either an excessive or diminished action of the cerebro-spinal organism, in whole or in part, or it may be by an irregular or perverted action of the same; by, perhaps, spasm or paralysis, neuralgia or anæsthesia; by delirium tremens, or hysteric-coma, and so on. In other words, the ganglionic system being affected, we have just the same right to look for and expect the indications of its disordered conditions in the brain and spinal cord, as in the several viscera or the integuments; and hence the several affections above enumerated—apoplexy, epilepsy, hydrophobia, tetanus, delirium tremens, neuralgia, &c., &c.—may be referred, not unfrequently, to the organic nervous system, and may be considered as dependent, oftentimes, and, *primarily*, rather on this system than on the cerebro-spinal. In all those cases where the

disease appears to originate in the ganglionic nerve-matter, and then as a sequence to involve the cerebro-spinal organism, the causes of the same may be described as twofold, viz., remote (ganglionic) and proximate (cerebro-spinal).

The identity or rather similarity of the several affections specified, is shown by various circumstances. In one patient you may witness, occasionally, and in a given time, a mixture of symptoms of an opposite character, realising, it may be, neuralgia, chorea, or tetanus, anæsthesia, or paralysis; such mixed cases are by no means uncommon. The epileptic are very subject to Apoplexy (*levis*), and what is more, are liable to attacks of *Tetanus*. These are, however, rather local than general—confined, perhaps, to one arm or leg, or to one side of the trunk—such attacks are, as a rule, very transitory. Epilepsy and hysteria are now and then approximated in so delicate a manner, that in certain cases the diagnosis is extremely difficult; and the *coma* which occurs, in some cases of the latter, I have known to be mistaken for that of apoplexy, and, what is more, treated on this erroneous belief. The young lady to whom I allude, the daughter of a noble viscount, was positively bled from the arm by her medical attendant, for the relief of merely hysteric coma.

During my official connexion with the Hanwell Asylum (1840 to 1844), I had at the same time under my care, three female patients, each of whom was an epileptic. Now these patients would realise, in any given month, almost every conceivable variety of nervous disorder, including paralysis agitans, hysteria, chorea, catalepsy, and tetanus. Such facts favour, in a very eminent degree, the opinion that these several disordered states of the body have one common cause or origin, and what is more, that these are nearly allied to each other.¹

¹ Nothing surprised me more in connection with the circumstances of the

I may add that, morbid action of a specific character (whether idiopathic or symptomatic it matters little), being

trial of William Palmer, for the murder of John Parsons Cook, than the want of decision and unanimity among the medical witnesses, in respect to what are called nervous or convulsive diseases. Now no class of practitioners sees so much of "fits," *i. e.*, of apoplexy, epilepsy, hysteria, tetanus, catalepsy, chorea, &c., &c., as the superintendants of large county asylums; and these gentlemen are well convinced that a combination of epilepsy with tetanic symptoms is by no means uncommon; that, in point of fact, the individual disorders (*i. e.*, the signs or symptoms by which each one is recognised), above named, or any two or more of them, are by no means, unfrequently, united, in the same patient. I do not hesitate to state it as my firm conviction that the difficulty lies rather in the way of discovering pure and unmixed cases of apoplexy, epilepsy, tetanus, hysteria, catalepsy, &c., as described, not by modern authors, perhaps, but by writers of another stamp, and of a past era, than in witnessing what may be called *anomalous* or *complicated* cases.

Some little time since, I was asked to meet Mr. Waddell, of Fishponds (Bristol), in consultation on the case of a young lady, æt. 16, whose mother was during her lifetime the subject of epilepsy, and which disorder is hereditary among the younger branches of the family. Our patient was suffering from *suppressio mensium*; but to this circumstance no great importance was seemingly attached by those about her. On my first seeing her, the bowels were, and had been for some time, obstinately constipated, and although large doses of powerful medicines, as calomel, croton oil, black draught, with turpentine enemata, &c., had been given, they had failed to afford any relief. I was informed that my assistance had been sought, on account, chiefly, of the "fits;" these were of common occurrence, so many as five or six would attack her in the course of the twenty-four hours. The paroxysm, though generally of short duration, would now and then last for some hours. The "fits" were described as of an epileptic character. The abdomen was somewhat full and hard, and on the right side, under the false ribs, there was a dull, constant pain; not much, if at all, aggravated by pressure. Tongue flabby, and covered in great part with a creamy mucus; the sides of the organ were marked by the teeth; altogether, it indicated an atonic condition of itself, and the *prima via*. The head was cool, the skin every where moist, and the pulse small and weak, exceeding 100. After waiting, but in vain, for some effects from the drastic purgatives prescribed, Mr. Waddell and myself agreed to commence the treatment of the case by giving small and repeated doses (gr. ij) of Ext. Aloes Aq., with a grain of blue pill, and a quarter of a grain of the Ext. Nux Vom. A dose (gr. 50) of Pulv. Jalap co., was ordered to be given in the early morning. In twenty-four hours

set up in the organic nervous system, it would seem, as a very general rule, to pursue a given course or circle, which at length reaching the culminating point, terminates in

the bowels were well and effectually emptied; the patient was greatly better. The pills of Aloes, &c., and the Pulv. Jalap co., were continued according to circumstances, and with no diminution of their good effects. Hip baths and mustard poultices to the sacrum and pubic region were directed, together with the Git Quini c. Ferro internally. After some sixteen or twenty days, the catamenia made their appearance. However the "fits," which seemed to absorb the principal care and anxiety of this young lady's relatives, had not only not left her, but had become both more frequent and of longer duration. It appears that during one particular attack, those about her became greatly alarmed, and not finding Mr. Waddell, a messenger was despatched for myself. I found our patient not in an *epileptic fit*, but in one more like catalepsy. She was, or seemed to be, wholly unconscious, with the eyes firmly closed; but all the *flexors* of the arms and legs were in a state of perfect *tetanic rigidity*; the fingers and thumbs, also the toes, were so firmly clenched, that my best efforts to move them were in vain. I was told that all her former fits had been of precisely the same kind as this one. Now the cerebral features presented in this young lady, *i. e.* her want of *consciousness*, forbids the bare idea of *tetanus* (*per se*,) whilst on the other hand, the morbid tonicity or spasms of the muscles of the extremities, their *fixed* and *immoveable* condition, precludes the possibility of regarding her case as one of catalepsy. Certainly, it was neither one or other of these diseases; but it partook of symptoms common to both *tetanus* and *catalepsy*. I should add, that consciousness and not less the normal condition of the motive powers, in other words the brain and the muscles, were directly restored or brought into their normal state, by the use of cold affusion. I stood on a chair by the side of the couch on which my patient lay, and poured a couple of pints of cold water on the head and face; when she sighed deeply, and then sat up, perfectly recovered. Much the same treatment (with the shower bath), as that above detailed, was continued; and, after some weeks, these peculiar "fits" left her. Our patient was cured.

A gentleman (insane) under the influence of *emotion* fell in an epileptic fit; I saw him almost directly. After some ten or twelve minutes, or on the decline of the convulsions or morbid muscular movements of the trunk and extremities, and before his *consciousness* returned, the arm and leg, on the left side, became tetanic, and in this state were immoveable. This *tetanus* lasted half an hour. The same patient has, to this time, what his attendants call *fainting fits*, but which seem to my mind, to come, more properly, under the denomination of cataleptic-trance. He does not seem to lose altogether, or entirely, his *conscious*

various ways in this or that portion of nerve-matter, giving rise to one or other set of symptoms recognised as either epilepsy, hysteria, chorea, neuralgia, delirium tremens, paralysis, or anæsthesia, and so on. It is worthy of mention in this place, that the restoration of a party *mesmerised* to his or her natural state of being, has been attended ere now by various fleeting and temporary indications of nervous derangement, simulating chorea, tetanus, neuralgia, &c., including also a loss, more or less complete, of the sensory, or it may be the motor powers.

If one were asked for the seat and nature of this "morbid action of a specific character" just mentioned, he would not be far wrong if he referred his inquisitor to the large and important organs within the abdomen. It but rarely happens that persons afflicted with *nervous diseases* do not exhibit signs, more or less evident, of something amiss with the liver or stomach, or parts accessory or subordinate thereto. A delicate and susceptible young woman is engrossed with the fascinations of the "réunion" or ball-room, and while exposed to the abominations of an impure and overheated atmosphere, with her brain and nervous system rendered too

faculty, and so far the poroxysm may be described as something on the border line between genuine catalepsy and "*reverie*."

At the Hanwell Asylum, I met with some few very similar cases, but these were among the female patients. One case in particular occurs to me, *it* was remarkable for the length of time during which the paroxysm lasted. I have known the young woman alluded to remain, with hardly an intermission, for three or four days, in a state of mixed hysteria and catalepsy, *and* tetanus. During this period she took scarcely any nourishment; but the state of the bladder was such, that I found it necessary, on some occasions, to employ the catheter. A second female patient, affected in very much the same way, was subject to attacks of local *tetanus* (not chorea); it was confined to one arm. If I remember rightly, both of these women were admitted as "epileptics."

(Mem.: Dr. Camps has recorded a case very similar to the above of "irregular intermittent tetanic catalepsy," in the 'British Medical Journal,' for January 24, 1857.)

keenly susceptible to all passing excitants, she is induced to partake of lobster-salad, pastry of various kinds, iced cream, champagne, &c., these, with the addition of fruits, sweet and sour, including sundry pickings of the most successful efforts of the ingenious professor of the culinary art, cause the vital organs to rebel—they protest, earnestly, against such an invasion of their just rights. Our patient leaves behind her *the gay and festive scene* but to find herself an invalid, and exposed to sundry medical attentions—a poor substitute for those so recently offered her. Though she may escape an attack of apoplexy (levis), her medical attendant may find her suffering from threatenings of epilepsy, or not unlikely, in a confirmed epileptic fit; or, it may be, in so aggravated an hysterical paroxysm that he feels not quite certain what to call the disorder. An emetic, followed by a free action on the bowels, will quickly remove the more urgent features of the case; but the next day complaints are made of a “fainting fit” (hysteric coma), and pains (neuralgia) or spasms and cramps (tetanus) in the arm or leg; these, however, will disappear under the use of suitable and efficient aperients, with a proper attention to diet, and so on.

In all cases of gastric disturbance, *i. e.*, of disordered action of the chylopoietic viscera, however induced, and existing either as an original affection, or as an effect of cerebral mischief, for example, the ganglionic nerve-matter—which enters so abundantly into the formation of the stomach and intestines, the liver, spleen, and pancreas, &c.—is necessarily, sooner or later, involved in the mischief. An *eccentric* disease of the organic nervous system is established, which is reflected back, through the medium of its intermediate ramifications, to the several ganglia of the sympathetic; the effect of which is, these several roots of this all-important division of the nervous organism are no longer in a position to supply to the body at large, including the brain and the spinal cord, the

necessary and normal stimulus to action ; and disease, of some kind or the other, is set up. Under the circumstances cited, as all parts of the body are brought within the vicious circle, there is no such thing as predicating the locality of the disease ; nor is it possible for us, in ignorance of all the antecedents of a given case—as to the general health, predisposition to abnormal action, the duration and intensity of the several external sources of deranged action in the system, their order of occurrence, and the thousand other items concerned—to say how, or in what manner, this or that organ may be affected. It is sufficient that the cerebro-spinal system, being thus deprived of *its* “normal stimulus to action,” the nutrition of this structure is impaired ; and, as a consequence, it is in no position to continue the performance of its allotted functions in the animal economy. This mere *inability* may or may not be exchanged for more positive indications of mischief ; and if these occur, there will be perhaps delirium, with illusion of the external senses, and perverted moral feelings and desires ; or the patient will be attacked with symptoms of an epileptic or hysteric character, or he will complain of neuralgic or tetanic pains. In a word, the normal state of being of one or more portions of nerve-matter will be very materially deranged, although the morbid phenomena which present themselves will be of that nature, and hold such a relationship to the healthy function of such one or more parts, that the medical man will have little difficulty in locating the disease he is called on to treat.

To revert to the imagined case of the *delicate and susceptible young woman*—such may be with much propriety regarded as an *eccentric* affection of the organic nervous system, or as symptomatic ; that is to say, the abnormal condition of the organic nervous system was an effect of a pre-existing cause. However to neuro-pathologists there appear good and conclusive reasons to believe that the ganglionic nerve-matter is often-

times the seat of primary disorder—of idiopathic derangement of function. Individuals of a lymphatic temperament, and in a humble station, whose powers of life are evidently at a low ebb, and who carry with them from their early childhood the indications of a general debility, may be said to labour under a congenital impairment or defective tone of the functions of organic life. Others, again, being placed in unfavorable circumstances, or reduced in position, and surrounded, therefore, with the miseries, discomforts, and wants which belong to that dread fiend—Poverty, acquire after some time a precisely similar impairment or defective tone of the said organic functions : all such persons are, of course, more liable than is usually the case to every variety of disease ; but they are prone more especially to those assigned to the nervous system.

It is well known to those who have the care of the insane, that among this class of patients nervous affections of all kinds are rampant, and that these exhibit every conceivable form and variety. Of 490 females under my care at the Hanwell Asylum, there were eight per cent. subject to epilepsy ; of 840 females under my care at the Colney Hatch Asylum, there was a trifle over nine per cent. afflicted with the same disorder ; to say nothing of the manifold complications of this malady in the shape of tetanus, chorea, paralysis, &c. It is also very well known that the ill-fed—the pauper class, furnish by far the larger number of cases of lunacy, due regard being given to the population in the different ranks of life. The above is an important fact, and bears closely on this part of my subject.

I would have it borne in mind that it is by no means my wish to deny the frequent occurrence of such an abnormal state of the cerebro-spinal system—in whole or in part—as results in apoplexy, epilepsy, paralysis, chorea, tetanus, and so on. Doubtless the brain and the spinal marrow, including

the organic dependencies of both of these organs, are liable to primary, *i. e.*, idiopathic, disease; which is, of itself, competent to the development of any one of the "neuroses" already named. The fact, however, in no way invalidates the contents of the foregoing pages.

The peculiar symptoms which belong to the "paralysis of the insane," would seem to be associated primarily with the organic nervous system; the history of any given case would be found to harmonise with this view of the disease named. The "paralysis of the insane," it must be remembered, is very unlike an ordinary attack of paralysis: the former is no effect of a sudden seizure, attended with congestion of the brain, or the rupture of a blood-vessel on its surface or into its substance; nor must it be regarded as a necessary sequence of cerebral degeneration (*ramolissement*). The affection is one *sui generis*; it involves, in the first place, the excito-motory functions,¹ both the sensation and the motive

¹ In a paper entitled the "Diagnosis of Insanity," in the 'Asylum Journal of Mental Science,' by Dr. Bucknill, the following words occur:—In the earlier stages of general paralysis "there is no other disease for which it can be mistaken. In the majority of cases the symptoms are sufficiently distinctive in the latter stages also, but I have ere now experienced difficulty in distinguishing a case of advanced dementia with habitual hesitation of the voice from general paralysis. The want of muscular affection in the lips and limbs, and the difference between vocal hesitation and the want of articulating power decided the diagnosis. Cases also present themselves in which many of the symptoms of advanced paralysis are caused by double apoplexy; cases in which each side of the body is in the condition observable on one side in hemiplegia. When both sides of the body are paralysed, the signs of hemiplegia afforded by the unequal contraction of symmetrical muscles is lost. On this principle, jockeys are said sometimes to disguise a horse's lameness by placing a stone between the shoe and the hoof of the sound foot. Lameness in both legs is less likely to attract notice than lameness in one. The physician is often introduced to such patients for the first time when they have lost all power of conversation and of locomotion, when they are bedridden and silent, or able only to answer in monosyllables. In such instances, the diagnosis of the exact nature of the disease has indeed little practical value, but its difficulty and its scientific interest in-

powers of the patient become impaired. The indications of the disorder are seen first, as a very general rule, in the altered and tremulous action of the muscles about the mouth, and in that of the tongue; the presence of the saliva in contact with the mucous surface failing to excite any corresponding action of the sentient nerve-structure, the patient is constantly dribbling; but of this he is scarcely conscious. The speech "lingers" (Conolly), and the legs are observed to be a little unsteady. With this *paralysis* of the spinal function there is seen very unmistakeable evidences of mental alienation. The character has become altered: its well-known and natural traits are lost, and in the stead of these there have grown into existence an eccentricity and a peculiar haughtiness of manner and deportment. From having been a reserved and discreet man, and in every sense prudent in the direction and management of his affairs, he becomes noisy and boastful, takes to drinking, makes large purchases, and, not unlikely, gambles. After some time, and in the absence

stigate the attempt to make it. In the year 1852, I published in the 'Report of the Devon County Asylum,' an account of some experiments I had made in the diagnosis of such cases by means of the electric stimulus. The electro-galvanic apparatus was applied by me to the lower limbs of patients suffering from mental disease without paralysis, from dementia with ordinary paralysis, and from dementia with general paralysis. The result of my experiments proved that in dementia without paralysis, and in dementia with ordinary paralysis, there was no loss of excito-motory sensibility, while in general paralysis there was a great loss of this power. In some cases the strongest stimulus of the electro-magnetic machine failed to produce any movement in the legs of the patient beyond a slight tremor, not amounting to muscular contraction or capable of moving the limb in the slightest degree. This experiment may be more conveniently, but less effectually tried by tickling the soles of the feet. In common paralysis muscular contraction is caused; in general paralysis it is not caused. *These experiments established a pathological rule of much importance in diagnosis, that in paralysis having its seat in the brain the excito-motory function of the nerves is not lost; that in general paralysis, the pathological conditions of which involve the whole nervous system, the excito-motory sensibility is almost abolished."*

of any successful treatment, all the symptoms are aggravated; sensation and motion have declined yet more from their normal state; and the articulation has become more and more imperfect, and, perhaps, "scarcely intelligible" (Conolly). The paralytic affection involves, by slow degrees, the whole body and the extremities; the mind loses its powers; the patient is incoherent and fatuous; and after lingering for some months, or, it may be, for even two or three years, he dies; his *cerebro-spinal organism* having, through a slow and tedious process, perfectly exhausted itself. The patient has lived sufficiently long to be reduced to a mere vegetative being.

To watch the gradual decline of him affected with "general paralysis," is to observe the slow yet certain breaking up, or annihilation, of the organic nervous system. Its outworks are the first to suffer—the cerebro-spinal system discontinues to receive its normal amount or natural quality of nervous (vital) power, and, as a consequence, its functions are impaired; *that* upon which the adaptation of man to the external world depends being at fault, he no longer obeys the natural laws, in so far as these relate to his intellectual, or emotional, or sensuous attributes. The progress of the disorder involves, at length, not only the *animal* but the organic functions; the cessation of volition, consciousness, sensation, and motion, is attended with a positive breaking up of all the vital phenomena, as they exist throughout the whole organism. The circulation, respiration, calorification, digestion, secretion, absorption, all fail; each instrument of *life*, wanting the *promethean fire* wherewith it had been, for a longer or shorter period, sustained, becomes more and more exhausted, and ere long ceases to act—and all is over.

As confirmatory of this view of the pathology of "general paralysis," I may mention here that patients so afflicted give few, if any, signs of pain, under circumstances requiring the use of the knife; that wounds, of whatever kind, heal in them

but slowly and with much difficulty and trouble ; moreover, such patients exhibit a marked tendency to hæmorrhage, on comparatively small occasions—a fact, by the way, which obtains equally among persons suffering from a cachectical constitution, in whom the normal contractility of the arterial system is, plainly enough, at a discount.

That form of “paralysis” seen in children among the pauper class, is, as it appears to me, to be referred generally to the ganglia of the great sympathetic nerve, and, in particular, to the great solar ganglion ; and not, *primarily*, to the spinal cord : this latter, it is true, gives evidence of disorder, of impaired function—but is it not right to conclude, from the *antecedents* or history of cases of this kind, and in the absence of all signs and appearances of disease about the osseous (spinal) system, that the medulla-spinalis has become affected, as a sequence, or secondarily ? What else can be looked for from the continued operation, on the delicate nerve-structure of the children of the poor, of impure air, deficient clothing, and unwholesome or insufficient food, &c.—in a word, of a vicious hygiene, but the external signs or symptoms of a defective nutrition—an exhausting vitality ; and what more reasonable than that, under such circumstances, we should view the same in connection with that portion of the organism on the integrity of which we have been accustomed to associate health and animal vigour, and so on ? The defective motive power of one or both extremities, as the case may be, is but an accompaniment of a cachectical or asthenic condition of the constitution at large but *one* of the many external signs of a want of *tone*, of not only those internal parts or organs supplied with nerves from the great sympathetic ganglia, but of the *great sympathetic ganglia* themselves.

I was consulted about three months since (*this was written during my residence at Ceylon, and in 1845*), respecting a little girl who had been supposed to be suffering from either a spinal

affection, or from disease within the left hip-joint. She seemed unable even to stand alone when unsupported. The leg of the affected side looked, to the casual observer, shorter than the other member ; and, as an effect only of long disuse, it had become smaller—the muscles had wasted. She had, moreover, acquired the habit of resting the great toe of the left foot against the inner malleolus of the sound extremity, giving to the case those ordinary physical signs which belong to the diseases named. However, the general antecedents of my patient, and not less the existence of a morbid state of the *primæ viæ*, and which latter I learnt had *preceded* for a long time the *paralytic* (?) disorder, led me to treat the case accordingly. The secretions soon became healthy ; and when the *primæ viæ* were got into a fit state to receive tonics and a generous diet, they were allowed. The use of the limb reputed unsound is now perfect, and the little girl runs about more lively than ever.

Hypochondriasis is a disorder than which none other is more plainly to be located in the organic nervous system. The weary feelings or morbid sensations of the hypochondriac are far from being so unreal as some medical writers would have it believed. His (the hypochondriac's) complainings do not result so much from the perverted fancy as has been taught : on the contrary, they are the consequence, and, especially so on the commencement of the disorder, of a matter-of-fact disease, involving portions of the delicate *nerve-tissue* composing, in great part, the entire organism. In proportion as pathologists look with a more delicate eye on the expressed sufferings of patients shall we refine medical science, and be then no longer content with the present coarse *vocabulary* employed to explain or describe morbid phenomena, as these occur in either the living or the dead.

The long persistence of strange and painful sensations in different parts of the body, upon whatsoever source depending,

cannot but act on the mind of the sufferer; having sought relief, but all in vain, and experiencing day by day an aggravation of his sufferings, he becomes anxious and apprehensive. Under these circumstances the case becomes complicated, ere long, by stomach-affection, and *indigestion* (a large word) is added to his other ailments. This state of things gives to the already fretful mind an additional grievance, another source of disquiet and suspicion; and unless some decided relief of the urgent symptoms is obtained, the brain succumbs, more or less, to the circulation through its delicate structure of a quality of blood in nowise compatible with its normal manifestations; a morbid sensibility of the cineritious neurine is set up, and, as a consequence, the patient give indications of *melancholia* so called. Hypochondriasis thus passes into melancholia, and the latter is not much more than an aggravated form of the disorder first named. However, from the first to the last, the pathognomonic feature of *hypochondriasis* is the persistence of morbid or painful (uneasy and peculiar) sensations in different parts of the body, whilst these so fix the attention of the patient that his whole life is tinged thereby, giving rise to great and distressing lowness of spirits. Now, inasmuch as these same *sensations* bear no relation to those morbid phenomena which are very properly associated with the true spinal or excitomatory functions, they can be considered but as dependent on some peculiar and abnormal state of the organic nerve-matter; which, as has been before remarked, constitutes the bulk of the entire organism of both man and animals.

A reference to the writings of the late Dr. Prichard, and to those of Dr. Copland, will reveal the opinions of these two eminent men in so far as the *nature* of hypochondriasis is concerned. From the following the reader will learn a good deal of what may be called the *pith* of the argument, *pro* and *con*. The first-named writer observes that "when we take

into consideration the mental dejection of hypochondriacs, the habitual state of their spirits, and the trains of morbid or painful sensations which torment them, we must admit that some deviation from the healthy state of the cerebral functions lies at the foundation of their ailments, though it is remote from organic disease, and of a kind of which we can form no conception. Many of the phenomena would, perhaps, lead to the opinion that the principal deviation from the natural state of functions is seated in the nervous system of physical or organic life; but phenomena involving consciousness and affections of mind can hardly be confined to this part of the nervous system." "Dr. Prichard," replies Dr. Copland "overlooks the fact that the brain itself is as much supplied with the organic nervous system as any other internal organ, and, consequently, that it will manifest disorder whenever this part of the nervous system is seriously affected; and that this disorder will present similar characters as to kind (as to depression, perversion, activity, or exaltation) to those displayed by other organs influenced by this system. The complaint, it is admitted, commences, or is first manifested in the digestive viscera, that is, as a very general rule, and it is not until the organic nervous system evinces great depression throughout the abdominal organs that the functions of the brain become also manifestly depressed or impaired; and then the depression observed in the energies of these functions is similar in kind to that remarked in the digestive, secreting, and excreting actions; these latter are performed slowly and imperfectly; intellectual power, attention, and application are also weakened. The sensibility of the organic nervous system is morbidly acute in all or several of the viscera, the cerebro-spinal system and the dependent organs of sense and volitions are also morbidly susceptible and incapable of the energetic exercise of their functions. The organic actions are performed with obscure sensations of

distress, difficulty, or anxiety, the mental operations are attended by fear, distrust, and anxious bodings. The vital manifestations throughout the economy are languid and relaxed, and the resistance opposed by life to morbid impressions remarkably weakened, the faculties of the mind are equally languid, and the tone of the cerebro-spinal nervous system altogether depressed." Dr. Copland concludes with these words, viz., " Dr. Prichard supposes that the occasional suspension of the complaint, for longer or shorter intervals of time, militates against the opinion that the disease is owing to the state of the organic nervous and digestive functions; but this part of the nervous system is as likely to experience remissions and exacerbations of disorder as the brain and its dependencies. At the commencement the affection of the organic or ganglial nervous system is confined *chiefly*(?) to the digestive and excreting organs; but at a more advanced stage it is extended to the brain, where it occasions the dejection of spirits, the fears and the anxieties connected with the patient's feelings and ailment, characterising the fully developed complaint." That the dyspeptic symptoms from which the hypochondriac suffers so acutely do not originate in the brain, but rather in the organic nervous system, is to be inferred from the simple fact that the connection of the cerebral and sympathetic systems is not essential to the vital acts of the *primæ viæ*, or, what is the same thing, to "the peristaltic motion." Drs. Bidder and Schmidt "divided the vagus nerve in the neck; but the movements of the stomach did not at all cease in consequence of such division, though the observations were protracted for several days; while the gullet showed the dependence of its motions on the cerebrum by becoming quite paralysed." (Chambers.)

The fact is, that in *hypochondriasis* the energy of the solar ganglion and that of its accessories is either perverted or diminished, and as a consequence both the brain and the

stomach are rendered incompetent to the discharge of their normal functions. The very same state of things is found to occur among females, and especially at what is called the change of life. The anomalous nervous affections concerning which the medical practitioner is so much consulted are located, as a very general rule, in the ganglionic nervous system. Women will commonly complain of "tightness," "heat," "cold," "trembling," a "sense of emptiness," or "sinking," &c., and refer the same to the solar ganglion, or rather to *the pit of the stomach*. How frequent are such complainings among those patient who have brought on themselves the consequences of protracted lactation; that they indicate a very considerable prostration of the vital energies is most certain. The history of any given case, and not less its general character, to say nothing in this place of the treatment found most efficacious, will make this point most clear. Insanity is evidently a disease of *debility* (debility is at the root of 99 per cent. of mental disorders) and the insane are very liable to all varieties of perverted and enfeebled action of the ganglionic centres, to "fulness," "heat," "cold," "a sense of emptiness," "sinking," &c. These terms now employed are quoted by me from my own patients, and they are used to describe peculiar sensations referred to the epigastric centre. I have a lady at this time under treatment, suffering from *hypochondriasis* (melancholia), her age is forty-three, and the uterine function has been checked from exposure to cold, &c. On rising in the morning she feels so prostrated from, as she says, some feeling in the pit of her stomach, that she is assured she dare not remove her folded hands from over the position of the *solar ganglion*. However, after she has taken her breakfast this very troublesome symptom subsides.

A lady, concerning whom I was consulted, and whose habits had become more or less intemperate, told me that without

brandy, or strong coffee, or opium, or the use of tobacco, she must die from a "faintness in the stomach." She was described as labouring under "melancholia;" but according to her own account her only positive anxiety was lest her hair should fall off, and she should become bald. To avert this threatened (?) catastrophe she devoted her whole time and attention, and expended much money. I need not add that the story of her hair was but a morbid fancy. The *uterus* in this case was much at fault. Cardialgia, regarded as a symptom of stomach-affection (dyspepsia), is common to both sexes, but more particularly to females; it indicates as a very general rule that the stomach itself is not duly supplied with nervous power; or, in other words, that the great sympathetic nerve is in no position to keep up the supply of its wonderful—its promethean fire, to the subordinate organs in general, and to *the stomach* in particular. It is true *cardialgia* may seem not unfrequently to be located both primarily and altogether in the semilunar ganglia; but inasmuch as the *stomach* gives, in the *majority* of cases of this kind, evidences more or less palpable of derangement, inasmuch as *indigestion* in some one or other form is present, it would appear reasonable to conclude that the organic nerve-matter entering so abundantly into the formation of the upper portion of the alimentary canal is much involved in the disorder so named; but doubtless "cardialgia" may be either a "centric" or an "eccentric" affection.

To realise the numerous and capricious symptoms which attend on or accompany "cardialgia" so called, it may be as well to recall to mind the various and dissimilar effects arising from mechanical obstruction or pressure of any kind of, or on, the solar ganglion, and its manifold ramifications about the epigastric centre. A reference to the preceding pages will demonstrate the dependence of not only the *primæ viæ* on the ganglia of the sympathetic, but also of the heart and lungs,

&c. ; and, after what has been already stated in these pages, it is hardly necessary to insist on the abnormal phenomena which attend on even a comparatively simple blow on the epigastrium, over the great nervous (ganglionic) centre ; and the mere *effects* of a simple blow may, of course, arise from causes having an internal and vital origin. The occurrence of palpitation of the heart, of impaired and difficult respiration (asphyxia)—of faintness or sickness—of irregular spasmodic pains or symptoms—of partial and temporary anæsthesia—and sometimes of paralytic feelings—may be expected in those patients who have been long subject to “cardialgia;” and more particularly in women at the change of life.

It is too common for us to be content with the term “hysteria,” and to imagine that this mere *word* conveys a sufficient description of the anomalous nervous affections above referred to or enumerated, and occurring more commonly than otherwise to females. I cannot doubt that, at a future day, when the physiology and pathology of the ganglionic nervous system will be so much better known, then the profession will demand a larger amount of accuracy, and a more scientific phraseology.

There is another class of diseases, the pathology of which is little understood, and which, though evidently *nervous* in its essential characteristics, exists independently, *in many cases*, of any PRIMARY cerebral or spinal affection. To this class I consider the following recognised diseases to belong, viz., neuralgia, angina pectoris, asthma, pertussis, including laryngismus stridulus (or the crowing inspiration of children), said to have been first accurately described by the late Dr. Lee.

With reference to the first named, one cannot well help remarking how frequently it is the accompaniment of the hysterical temperament ; a circumstance which no doubt indicates the existence of a cause common to both forms of abnormal action. I remember to have seen, in one of the medical

journals, some time since, a short notice of a work on *neuralgia* by Dr. Allnut, in which, if I am not greatly mistaken, that gentleman advocates the opinion that the organic or ganglionic nervous system is, in very many cases, that portion of the organism first affected in the disease named. Viewing the matter in this light, we are directly enabled to understand why the treatment adopted by the late Sir C. Bell, viz., *free purgation*, was found so very successful.

Of course, it is not intended by these observations to imply that no case of neuralgia may exist in which the cause of the disease is located from the beginning in the sensory fibres of the spinal cord, or in those of its branches. All that is intended is that, inasmuch as the existence of an abnormal action, involving any portion of the organic nervous system, may be manifested in any individual part of our organism, and so constitute an external and visible criterion of an internal and invisible disease, it must follow that the spinal cord may be, and is, from time to time, and on these grounds, involved in disease; thus neuralgia, equally with chorea, tetanus, &c., may be merely symptomatic, and independent of any *primary* spinal affection.

As concerns the *seat* and *nature* of ANGINA PECTORIS, Dr. Gurine considers the disease as a nervous affection, and adds —“the proximate cause consists of an affection of the pulmonary nerves, disturbing the functions of the lungs, impairing the decarbonization of the blood, and producing the pain in the sternum. This affection of the pulmonary nerves is communicated to the cardiac plexus, and deranges, secondarily, the heart and large vessels.” M. Laennec states that where there exists, simultaneously, pain in the heart and lungs, we may presume the affection is seated chiefly in the pneumogastric nerves; but where there is a simple stricture of the heart, without pulmonary pain or difficulty of breathing, its site is the nerves which the heart receives from the *great*

sympathetic. The reason given by Dr. Gurine why the *cardiac plexus* becomes secondarily affected is, to my mind, by no means satisfactory. It is not found that the impeded respiration which attends on the inhalation of irrespirable air, is either attended or followed by any symptoms of *angina pectoris*, which, to my mind, seems implied by Dr. Gurine. Neither do the symptoms of the disease, nor their order of occurrence, justify the above conclusion. If the attack generally commences with a sense of pain, pressure, or constriction in the *cardiac* region as it is described, and which pain, pressure, or constriction is succeeded by urgent dyspnœa, it would appear that the *heart* is the first to suffer, and if so, the "proximate" cause consists of an affection of the *cardiac*, and not of the *pulmonic*, plexus; or the branches of the former.¹

I cannot understand why M. Laennec did not consider that in cases where there exists, simultaneously, pain in the heart and lungs, we may presume the affection is seated in both the cardiac and pulmonic plexuses, *rather* than in the pneumogastric nerves; and particularly so when he believed that "where there is a simple stricture of the heart, without pulmonary pain or difficulty of breathing, its site is the nerves which the heart receives from the sympathetic."

That *angina pectoris* is a disease of the thoracic (ganglionic) or cardiac nerve-tissue there can be no reasonable doubt. Pathologists talk about ossification of the coronary arteries and veins, of induration of the valvular apparatus of the heart, and of enlargement, dilatation, and effusion of and about this organ; but they may rest assured that all such morbid phenomena, when they are found to exist, are nothing more or less

¹ The experiments of Brachet distinctly prove the dependence of the heart's action on the "cardiac plexus." Injury done to the "cardiac plexus" he has found to instantly arrest the movements of the heart, and to suspend circulation. (See Müller's 'Physiology'.)

than the mere effects of a pre-existing cause. One of the most eminent of medical authorities of the present century has declared that four fifths of the whole number of diseases which affect mankind are of an *inflammatory* nature, and that they therefore require, in some way or another, the abstraction of blood. Every one must agree with Mr. Lawrence in believing that few diseased actions are not, sooner or later, associated with inflammatory action of some kind. Let us, however, bear in mind that *inflammation* is as frequently as not an effect of a primary disorder; and that, in a great number of instances, the *cause* is of so peculiar a nature as not only to forbid depletion, but to demand the employment of tonics and stimulants; as I have before taken an opportunity to observe. Few practitioners, now-a-days, would bleed for the relief of *angina pectoris*, except under peculiar and complicated circumstances.

In "*spasmodic asthma*," it is observed that the muscular fibres which encircle the bronchial ramifications, being in a state of spasm and meeting with no opposition from the cartilaginous rings, which is the case in the large bronchi, the air is prevented entering into the small bronchi and pulmonary vesicles. The question is, *what causes this said spasm?* There is no reason why the brain or the spinal cord should be regarded as, *necessarily*, the seat of the disease. Experience has shown that the *pneumogastric nerves* are strictly cerebral nerves; that they are in no way concerned in the vital functions: but that they (by their anastomoses with the organic or ganglionic nerves) help merely to secure the union of the three great nervous powers, viz., the ganglionic, the cerebral, and spinal.¹ Now, the same power which continues

¹ This "union," or what is the same thing, the relationship or mutual dependence of the *organic*, *cerebral*, and *spinal* nerve-structures, viewed both

the peristaltic action of the intestines (and which of course presides over every involuntary movement of whatever kind) must of necessity enable the bronchial ramifi-

anatomically and physiologically, is well demonstrated by Dr. Schoenlein, of Berlin, who records a case in which a large fibrous tumour involved the first cervical ganglion of the sympathetic nerve on the right side, destroying the natural structure of the ganglion, and altering that of the communicating cerebral, spinal, and ganglial nerves. The patient, a female, complained of palsy of the upper extremities, with numbness and tingling, palpitation of the heart, oppression and suffocating sensations in the chest, and threatened asphyxia; of which she died.

In the work of the late Mr. Guthrie, 'On Injuries of the Head affecting the Brain,' we find the following quotation from Flourens, viz.: "Respiration consists of four movements: 1, the opening of the mouth, and dilatation of the nostrils; 2, the opening of the glottis; 3, the elevation of the ribs; 4, the contraction of the diaphragm. The division of the dorsal spinal marrow, below the origin of the phrenic nerve, paralysed the movement of the ribs; above the phrenic nerve, it paralysed the diaphragm, and respiration ceased; the yawning or opening of the mouth and glottis alone remained. On dividing the point of origin of the par vagum, the movements of the glottis ceased. On taking another rabbit, and beginning to slice at the upper part of the medulla oblongata instead of the lower, from before backwards, the opening or yawning of the mouth ceased; another slice, and the dilatations of the nose were arrested, and the inspiratory movements of the trunk alone remained."

Alison, in his 'Outlines of Pathology,' has these words: "The accuracy of the observation of Magendie, as to the use of the recurrent nerves in holding open the glottis during inspiration, has been illustrated by curious pathological observations, in which it has appeared that aneurisms or other tumours, under the upper part of the sternum, by which that nerve must have been compressed, have been attended with occasional spasmodic closure of the glottis; the voluntary power of antagonising any spasmodic action of the muscles closing the glottis (and moved by the superior laryngeal nerves) having been thus apparently lost."

The case of Schoenlein proves that much, if not all the distress and pain which Flourens describes as consequent on his cruel experiments, might result from disease or injury confined to a single ganglion of the great sympathetic nerve. Of this, too, we may be sure, that if it were not for the due supply to *the recurrent nerves* of the "promethean fire" derived from the ganglionic nerve-structure, *they* would be wanting in their power *to hold open the glottis*, or, in any way, to facilitate the respiratory function.

cations to perform their peculiar office in the animal economy; and if so, what but this same power, or portion of our organism, can be concerned in the development of diseased action in them.

If the respiratory function depend on the organic integrity of the lungs, and if this be dependent on the pulmonic plexuses, then must it follow that in regarding *asthma* as an indication of abnormal action existing in the pulmonic plexuses, (and in the absence of all proof to the contrary,) one cannot be far from the truth.

Upon the same principle of investigation, we shall satisfy ourselves of the *seat*, if not of the *nature*, of "pertussis" or whooping-cough.¹ What are the physiological uses of the superior cervical ganglion? That its internal branches, which are distributed to the larynx and to the parts adjacent, and there form communications with the cerebro-spinal nerves, enable the muscular structures there to execute their proper functions, cannot be doubted; that they mainly, if not entirely, impart to the sentient and motory nerves distributed to this particular part of the throat the power to perform their peculiar offices is certain; and if so, and in the absence of any facts which can induce us to refer this distressing complaint to either the brain or spinal cord, or to their subordinate parts, it is fair to refer *pertussis* to some affection of the superior cervical ganglion, or of its internal branches. The same portion of our organism which preserves the healthy movements of the larynx, it is more than likely presides over those which are diseased.

¹ Dr. Copland considers that the medulla oblongata is the seat of this peculiar disease, though not exactly its origin. "Irritation," he says, "is first set up in the glottis and its vicinity, which, through the medium of the respiratory nerves, is transmitted to the medulla oblongata, where it aggravated and perpetuates the primary affection." (See article "Pertussis," p. 242.)

In *laryngismus stridulus* we have phenomena by no means dissimilar in their nature, though, of course, very much modified. In both hooping-cough and the crowing inspiration the glottis becomes much reduced in size; but in the latter disease more so than in the former: luckily, however, the closure is only very temporary. The presence of scrofulous glands about the neck, or within the chest, lying in contact with either the cervical or thoracic ganglia or their ramifications, would of itself be sufficient to produce all the phenomena of this last-named disorder.

Angina pectoris, asthma, pertussis, and laryngismus stridulus, are, like chorea, so many involuntary and abnormal muscular (spasmodic) movements; and in these several diseases we are afforded the best examples possible of what is called IRRITATION—morbid sensibility (Billing); and which consists in an abnormal, yet *not* in an inflammatory excitement. This morbid condition is, therefore, as a rule, to be subdued rather by opiates and tonics than by bleeding.

Where there is irritation (morbid sensibility), the vascular system is deranged, but only as a consequence. The nerve-structure it is which is *primarily* affected. Although the spinal cord presides more immediately over *sensation* and *motion*, yet is there an abundance of reason to conclude that the ganglia of the sympathetic may and do, very commonly, impart so unwholesome an influence to this organ, as to seriously impair the healthy action of the muscular and other tissues subordinate to it; and under such circumstances, what may be looked for but neuralgia, or anæsthesia, or *spasm*, in some one or other form. The internal parts, as the heart and lungs, &c., are supplied but indifferently with spinal nerves; and hence is it that their morbid movements, of whatever kind, are so much

more directly to be referred to the ganglionic nervous system.¹

¹ I am reminded that, in an interesting article in the 'British and Foreign Medical Review,' and in which the theory of inflammation known as the "neuropathic" or "neuro-pathological" is very ably treated, Mr. Paget has taken an objection to the views of the "neuro-pathologists." The "firmest tendons and articular cartilages," this gentleman argues, are liable to inflammation, and inasmuch as these have no nerves, such "inflammation" must be independent of everything like a *nervous* origin. Certainly "the firmest tendons and articular cartilages" are without traces of cerebro-spinal nerves; but, I would ask, do not these structures contain *organic* or *ganglionic* nerves? That they do so is undeniable. Mr. Simon takes the same view of this question as Mr. Paget, and so also does Mr. Wharton Jones. The former writer refers *not* to what he supposes nerveless structures, viz., tendon and cartilage, but to paralysed parts, and those rendered nerveless by operation or division of nervous trunks—to *cerebro-spinal nerves*. Mr. Simon gives a case of anæsthesia of the fifth nerve, dependent on organic disease, wherein the local contact to the conjunctiva of a few grains of cayenne pepper caused violent inflammatory symptoms. This gentleman adds, "no nervous excitement could have preceded this said inflammation, because the fifth nerve was annihilated; the patient operated on suffered neither from pain nor from lachrymation." Mr. Wharton Jones in his lectures adopts a very similar line of argument to Mr. Simon; he, however, would seem to agree with Dr. Billing in supposing that capillary congestion or "dilatation" (Henle), *alias*, the "stagnation of the blood," is in some way directly dependent on the suspension of the nervous influence upon the *arteries* and not on "nervous excitement."

The time is not far distant when *inflammation*, whether of a *sthenic* or an *asthenic* character, and of whatever structure, whether external or internal, will be looked on as the mere effect of an antecedent morbid impression confined to and affecting the nervous (organic or ganglionic) tissue. The following words are from a small book of my own, entitled 'The Nature and Proximate Cause of Insanity;' I cannot doubt that they are not less applicable to "the internal parts, as the heart and lungs, &c." (see text), than to the brain. "If *morbid sensibility* occurs to the nervous tissue of a part, the consequence either of the application of an external stimulant, or the result of some accidental and internal or organic change, the capillaries, although they may resist, more or less, and for a given time, the injurious effects of the same, are ultimately rendered incompetent to the proper discharge of their offices in the animal economy; and losing the *tonicity* natural to them, and through the instrumentality of which the blood is forced onwards through their delicate

It is asserted on the authority of, I think, Müller, that if caustic potash is applied to the cœliac ganglion of a rabbit, the whole intestinal tube is thrown into a violent peristaltic action; and if the same structure in the calf is brought into a state of inflammation—by either the application of caustic potash, or by pricking or laceration, &c.—then will severe pain be indicated. These facts prove to us that both *motion*

textures, they become congested, their parietes yield to the pressure of the contained fluid; and unless this be relieved, inflammation, more generally of an *asthenic* character, is set up, and the chances are that a certain amount of disintegration (of the tissues involved) follows; and to this succeeds the various necroscopical appearances observed in the brain and its membranes, among those dying insane.” The longer we live, says a reviewer in an old number of the ‘Medico-Chirurgical Review,’ the more we see and the deeper we study, and so much the more are we convinced, that not only are the primary *impressions* of morbid causes sustained by the *sentient* system of the human fabric, but that it is in *this* system the primary morbid *movements* first begin, and are thence propagated to the vascular system; which, from that moment, reacts upon, and is again influenced by, the nervous system. “All diseases commence,” says Dr. Billing in his ‘First Principles of Medicine,’ “by disturbance of the function of the solid parts of the machine; and first of all, of the nervous system. This is ‘solidism,’ or ‘neuro-pathology.’ The nervous system regulates and supplies all with energy; there is no organic sensibility, or organic contractility, independent of the nerves. Every *natural impression* is received by the nerves; every *morbid agent* is first felt by, and operates upon, the nerves. Inflammation of cellular tissue, bone, conjunctiva, &c., through mechanical or other violence, result in consequence of injury to the peripheral nerves, and to the capillaries; fever, from injury to the centres of the nervous system, which arises either from peripheral injury propagated to them, or through lesion by miasma, which, by the route of the circulation, directly poisons them; most probably by chemical combination and alteration, instantaneously lowering their power or energy. I have shown throughout,” he adds, “that the immediate effects of the lowering of the power and energy of the nerves or nervous system is inflammation, or congestion of the capillaries,—the first degree of inflammation.”

The reader is asked to bear in mind, that “the solid parts” or the *nervous tissue*, named above, refers *not* to that having its source or origin in the cerebro-spinal organism, but includes, only, the ganglionic or ganglial nerve-matter, the great centre, or centres, of which is the solar ganglion and *the chain of ganglia* running the whole length of the body or *spine*.

and *sensation* may occur, under peculiar circumstances, to the ganglia of the sympathetic, independently of the spinal organism; or, in other words, that *spasm* and *neuralgia* (morbid motion and sensation) may attack any one of the internal viscera, any one of the vital organs engaged, hitherto, in the performance of a normal and involuntary (automatic) function; and this in virtue of a certain morbid condition of the ganglionic nerve-structure entering into the composition of such *viscera* or organs. The uterus may be named as an example; in health this viscus supplies a peculiar (periodical) secretion; this is the product of a normal (*involuntary*) and unconscious act peculiar to it; but under circumstances of disease the same organ becomes the seat of spasm and pain (dysmenorrhœa), and then it is that the transmission of morbid sensations to the brain, through the medium of minute ramifications of the spinal nerves *and* the cord itself, gives the patient a positive knowledge of her sufferings; thus converting a normal and unconscious act into an abnormal and conscious one.

A highly interesting example of "mollities ossium" (a matter this in close relationship to the present subject) came under my care during my residence at the Hanwell Asylum (1842).¹ It is seen that I have ventured to express it as my opinion that rickets, fragilitas, and mollities ossium, are, *as they are generally described*, but varieties or modifications of one and the same disease; and what this is, it will be my endeavour, as I proceed, to make apparent. That the bones are liable to become both fragile or brittle *and* softened, is most true; and that, moreover, a fragility *or* softening of the bones is, in either case, the cause of *rickets*, literally speaking, cannot be denied. Every one knows that the normal physical characters of the skeleton are dependent on the due admixture of the earthy

¹ See 'The Medical Times,' No. 170, vol. vii, p. 195.

and animal constituents of bone ; it follows, therefore, that if either the one or the other of these are in excess, the osseous structure can no longer preserve its normal characteristics ; the skeleton, *then*, may give indications, more or less evident, of disease—of deformity. If the phosphate of lime exceed its natural quantity, the bones are then rendered brittle, and the individual may be said to be suffering from “*fragilitas ossium* ;” such is natural in extreme age. If, on the other hand, the animal matter predominate, then the bones are observed to be so soft and flexible (*mollities ossium*), that they may be even bent to and fro with impunity. (I have met with three cases in which the long bones of the extremities were bent by violence to an oblique angle, without being fractured. They occurred to children of the respective ages of 7, 11, and 13 years. In the first the leg was the seat of injury ; in the others the forearm.)

Now the external and physical characters impressed on patients in either of these affections of the skeleton may be recognised in a general way by the term “rickets.”

The description hitherto given by Boyer, Cumin, and others, of the above diseases, so named, apply, as it seems to me, to that very peculiar affection of the bones to which Dr. Copland has given the name of “osteomalacia ;” whilst Mr. Solly has suggested the addition of the words “*rubia*” and “*fragilas* ;” and which disease, in its accession, progress, and termination, presents certain *physical* characters, to which alone our ideas of it have hitherto, as a very general rule, been confined ; and hence the employment of the terms in use, viz., rickets, *fragilitas*, and *mollities ossium*.

In the report of the case of “*mollities ossium*” before referred to, I have asserted that it is a peculiar and atonic affection of the bones ; and one consisting of something very much more than a mere disproportion of the salts and animal matter of the osseous structure.

It is said by Mr. Solly that "osteo-malacia" (Copland) "is a disease of an inflammatory character;" it would appear, however, that "the artificial redness of the parts" which this gentleman attributes to "a morbid and inflammatory action of the blood-vessels,"¹ is not a little irreconcilable with the idea of the existence of "some connection between this disease and scurvy." (Solly.) Writing of osteo-malacia, Mr. Curling observes that "it is in every respect a premature decay of the osseous system." That "osteo-malacia" is an accompaniment, if not an effect, of an impaired vital energy, however induced, is most true; and so far, perhaps, it holds a relationship, more or less close, to scurvy. Moreover, it should be added that both Mr. Gooch and Dr. Pringle have recorded cases, in the 'Transactions of the Royal Society,' wherein the symptoms of scurvy and osteo-malacia were strikingly united in the same patients. In both forms of disease the liability of patients to ecchymoses, and even fractures, and these from very slight and seemingly insufficient causes, is a remarkable fact; in my own case there were found, after death, so many as six spontaneous fractures of the long bones.

It may not be out of place to remark here, in reference to the words "rubia" and "fragilas," that, presuming on the accuracy of the descriptions given to the medical world by Boyer, Stanley, and Gooch, as regards the *colour* of the semi-fluid substance found in the interior of "rickety" bones, then must the adjective "rubia" be found out of place; for the two first-named pathologists call it (*i. e.*, the semifluid substance) "brownish," whilst the last (Gooch) says it is "dark coloured." In my own case the *colour* of the same morbid product was certainly not so generally *red* as to authorise the adoption of the term "rubia." In so far as

¹ See Medico-Chirurgical Transactions, vol. xxvii, 2d series, vol. ix, 1845.

“fragilas” is concerned, it is sufficient to add that its employment would be *pathologically* incorrect; for this plain reason—whatever *fragility* there may be found in the skeleton, it is, plainly enough, in proportion to the quantity of bony matter which has escaped the ravages of disease. The thin crust or shell of bone observed on the examination, *post mortem*, of C. S. (the female patient at the Hanwell Asylum), and which enveloped the “dark grumous matter,” constituted all that remained of “the shaft of either the femur or the humerus;” the remaining portions of both of these bones, excepting their articulating extremities, having been converted into the said “dark grumous matter.”

As to the nature and proximate cause of “osteo-malacia”—for to this question are the preceding remarks intended to apply—I would submit that it is located in the ganglionic nervous system: the following observations may be considered to justify such a conclusion.

If we consider the structure of bone, and particularly the inconsiderable amount of spinal nerve-matter entering into its composition as compared with the very large quantity belonging to the ganglionic nervous system, we shall be prepared to expect that the skeleton is dependent for its healthy characters on this latter portion of our organism; and if this be conceded, it follows that whatever abnormal changes may occur to it, whether or not these are of a character peculiar to “osteo-malacia,” such must have a like dependency. If then the organic nerves so bountifully distributed to the bones, and constituting even (it may be said) a very considerable proportion of their bulk, get out of order, or are brought into a state of morbid sensibility from any external or internal, *i. e.*, from any *centric* or *eccentric* cause, then are the capillaries so altered in their action that all normal exhalation is suspended, and the secretions themselves are changed into an offensive and irritating substance.

If it is unnecessary to insist on the fact that if the organic or vital nerve-structure be intact, then must the vascular structures or capillaries in relation with it be found engaged in the performance of their normal functions; it is equally so to dwell on the evidence in favour of that opinion which ascribes to a deranged condition of the same organic or vital nerve-structure so faulty an action of the vascular structures and capillaries, that neither the exhalations nor the secretions can be else than of an unwholesome quality. Moreover, if such a "condition" continue unchecked—if the *circle* of morbid changes, commencing first in the organic nerves, then in the capillaries, and afterwards extending to and embracing the very exhalations and secretions (for even these, under the circumstances given, come at length to form a portion of morbid orgasm, to assume an organized existence, an abnormal reality, the result of a perverted (misdirected) nutrition) goes on, defying the efforts made to repair the injury and restore health, then may we look, according to the authority of the very best pathologists, for just those symptoms during life, and those appearances after death, which are mentioned and described in the very rare and interesting case of C. S., who died in 1842, when under my care, at the Hanwell Asylum.

The subjoined remarks from the pen of Dr. Copland are of much value. When treating of "preternatural exhalation and secretion," he writes, "The exhalation of serous surfaces or shut cavities may be altered according to the state of *organic action* in the surface producing them. Exhausted vital action and cohesion will be followed, according to its grade, by the effusion of an aqueous, serous, or sero-sanguineous fluid; the relaxed state of the capillary pores and serous tissue allowing, instead of a simple halitus, the escape of the watery parts of the blood, some-

times with a portion of its albuminous constituents, and even of its red particles; and under certain circumstances, as of obstructed return of blood from, and congestion of, adjoining parts, and dyscrasia of this fluid—states not unfrequently consequent upon *exhausted vital powers*—the effusion of a portion of blood itself. When *depression of vital power* and diminished cohesion of the serous surface are associated with increased action of the vascular system and contamination of the circulating fluid, the exhalations are not merely increased, they are also turbid, and of various shades of colour, from a dirty gray to a dark brown.” “When organic action is morbidly increased,” *i. e.*, in a state of morbid sensibility, “in serous surfaces, the exhalation is changed into a sero-albuminous matter, which is at first fluid or semifluid, but which afterwards assumes modified states, according to the grade of constitutional power and morbid action, and the particular characters such action presents, whether that of pure phlogosis or sthenic inflammation, or that of diffuse phlogosis or asthenic inflammation, or of the intermediate forms,” &c.

In his description of “secretions adventitious to the frame,” Dr. Copland thus refers to the “glue-like, or gelatinous matter, or colloid substance:” “Whilst *pus* and *tubercle* are chiefly composed of albumen, with varying proportions of water and salts, this secretion consists principally of gelatine. It is sometimes colourless, but it also occasionally presents shades from a yellow to a rose tint. It is without any trace of organization. It is either infiltrated in the areolæ of the tissues, thereby altering very much their appearances, or it is collected in one or more masses, which slightly condense the surrounding structure. When infiltrated into the cellular tissue it *generally* indurates this tissue, and constitutes a variety of scirrhus.” * * * “Morbid exhalation, secretion, and nutrition may be viewed as stages of the same organic action; exhalation passing into secretion,

and secretion into nutrition. Thus, we perceive, the natural exhalations during disease assume the characters of a secreted or elaborated fluid, and certain morbid secretions become more or less organized."

The same writer tells us that the natural exhalations or secretions into shut cavities, including, of course, the medullary canals of the long bones, &c., may be affected by a want of tone in the exhaling vessels and pores, or by an imperfect vital cohesion, or by both, as well as by a deficient action of the absorbents depending on diminished vital power; he adds, too, that the above several morbid phenomena are to be ascribed to the state of the "organic nervous influence." Dr. Alison confirms the opinions above quoted from Dr. Copland in these words, viz., "There is a great and general perversion of the nutrition and growth of bones in rickets, a state occurring chiefly in scrofulous habits, and produced by the same causes as determine the formation of the scrofulous diathesis; in which the bones are not only deficient in earthy matter, but do not acquire their usual structure; their cellular texture is less compact than natural; the contents of the cells gelatinous instead of being medullary, and the medullary canals are not formed in the interior of the long bones, while the extremities of these bones acquire an unnatural size. Such irregular depositions of phosphate of lime sometimes happen as show that the quantity contained in the system is not deficient, and that the fault lies in the vital powers and affinities by which the *nourishment* of this texture is appropriated." It would seem that *debility*, or a cachectic state of the constitution, underlies this peculiar affection of the skeleton (*osteo-malacia*), which is indicated in an especial manner by the state of the parts implicated; and that this may be regarded as an external, or rather a tangible sign of an internal or intangible, and not the less an *intractable* disorder. *Osteo-*

malacia, then, is a disease which has its origin in the ganglionic nervous system; and this is made evident by the altered action of the capillaries of the bones giving rise, not so much to a perverted nutrition of the parts affected, as to the exhalation or secretion of morbid matter into the cellular or cancellous portion of the osseous structures; and which morbid matter consists in an aqueous, serous, sero-sanguineous, or gelatinous fluid, of various degrees of density.

One word more: “*osteo-malacia*” may be confined to one or two bones, or even to a portion of the same bone; in the examination of patients who have died insane—inmates of the Middlesex asylums at Hanwell and Colney Hatch—I have met with five or six examples of this partial affection of the skeleton; the greater number of these patients were afflicted with “general paralysis;” an interesting fact this, and one which bears me out in the views here taken of both *osteo-malacia* and of this specific form of *paralysis* so common to the alienated.

Keeping in view the facts and principles contained in the foregoing pages, in so far as the functions of the ganglionic nervous system are concerned, and admitting the same, it follows that all the several normal secretions of the body are dependent on a due supply of nervous (ganglionic) power to the various organs or viscera supplying such secretions; or, in other words, that the gastric juice, the bile, and the urine, for example’s sake, are furnished respectively by the mucous surface of the stomach, the liver, and the kidneys, in virtue of the vital stimulus to action contributed to the organs named by the ganglia of the sympathetic. Let me ask, then, what may be anticipated if, from any cause, either an external or an internal one, the *renal ganglia* become diseased or altered in their structure, their component and delicate tissues disintegrated or broken up? Is it not certain

that under such circumstances the capillaries, or secretory apparatus of the kidneys, are no longer competent to the due discharge of their functions? Assuming an affirmative reply to the foregoing question, we should expect our patient to complain of either an altered quantity or quality of urine; the renal secretion would be found either diminished or increased, or otherwise altered from its usual and natural condition: now much has been written about *diabetes*, but very much has been omitted concerning the seat of this peculiar and fatal disorder. That diabetes has its origin in the renal ganglia, there appears much reason to believe. The kidneys in such a case are affected, but only as a consequence; the kidneys have become the external and tangible exponent of an internal and (otherwise) intangible morbid process. It appears to me that diabetes is, as the general rule, an idiopathic affection of the renal ganglia, and that this is made evident by a disordered and increased action of the kidneys, giving rise to a profuse amount of unhealthy urine. I should add, in justice to Dr. Copland, that he believes that diabetes is sympathetic, *only*, of a morbid condition of the assimilating organs; and that *this* is to be referred to a deficiency of "organic nervous influence."

In May, 1838, I assisted my friend, Mr. George Bore, now living near Colchester, at the post-mortem examination of a lad who died, under his care, of diabetes. We made a most careful inspection, and were rewarded by the discovery of what seemed to be a hypertrophied *renal plexus*; it was unfortunately lost, though put on one side, and in, what was thought, a place of safety.

There is another very serious disease, and, what is more, a very common one, concerning which the general ideas of the profession seem to require revision; I allude to *dysentery*. It is not too much to expect that the doctrine which ascribes the ordinary symptoms of dysentery to a pure and unmixed in-

flammatory condition of the mucous lining of the large intestines, will soon cease, or, at the least, undergo very considerable modification. In this disorder, than which none other is more common or occurs more frequently in the East, the natural secretions of the mucous lining of the alimentary canal become substituted by those of another kind; fluids mild and unctuous in their character are exchanged for others of an irritating and offensive quality. Now, it appears to me that such a circumstance could hardly transpire if the capillaries of the mucous membrane of the intestines were not brought within the reach of some especial and abnormal action; and if this be the case, from whence can such emanate but from the nerve-matter supplying to the said capillaries their peculiar properties or offices in the animal economy, whether under circumstances of health or disease? It may be urged that I am over-straining my point; but with those who are accustomed to associate the nature or quality of the exhalations and secretions from mucous and other surfaces with "the states of vital power of structure" (Copland), I am safe from any such charge. The dependence of the function of the capillary vessels on the integrity of the ganglionic nerve-structure is well insisted on by Dr. Copland in these words, viz.—"The exhalations and secretions from mucous surfaces are remarkably changed by the states of the vital power of structure, cohesion, and of organic action. When vital energy and cohesion are diminished, the watery exhalation from these surfaces may be increased, and transformed to a serous, or sero-sanguineous, or bloody discharge; particularly in some malignant and cachectic maladies."

It is the presence within the *primæ viæ* of the aforesaid *irritating and offensive fluids* which increases the internal and excito-motory functions, *i.e.*, the peristaltic action of the intestines; and hence arise the frequent dejections which attend on dysentery: and inasmuch as these dejections imply the

escape of morbid matter, the contact of which with the mucous membrane of the bowels can but induce irritation and inflammatory action, such must be regarded rather as *remedial* than otherwise. The first object, then, of treatment should be, *not* the discontinuance of the *purging*, so much as the removal of the cause to which the creation or presence of such noxious fluids can be traced, viz., the morbid sensibility of the ganglionic nerve-structure entering into the formation of the *primæ viæ* aforesaid.

Dysentery consists *primarily* in a disorder (irritation) of the organic (intestinal) nerves; and this it is which exerts so prejudicial an influence on the capillaries, that the mucous secretions are rendered highly noxious and irritating; the passage of which through the intestines may, or may not, develop inflammation in some form or the other—*sthenic* or *asthenic*.

Lest I may be thought dogmatical on this point, I will venture to place before the reader the opinions and reasoning of a writer enjoying the highest celebrity and reputation in relation to this department of pathology. A reference to the article "Disease" in Copland's 'Medical Dictionary' will discover the following words—they are pregnant with truth, and confirm in every particular the foregoing remarks: "Alterations of the secretions depend—1st, upon the state of the *organic nervous influence*; 2dly, upon vascular action; and 3dly, upon the condition of the blood itself;—depend, in fact, *upon the chief factors of organic action and life*; and they (the secretions) are thus indications of the manifestations of this principle. They may be—*a*, more or less diminished, as from causes which lower the organic nervous influence, or retard the circulation; *b*, or more or less *increased*, chiefly from agents which alter the distribution or determination of organic influence, and consequently of the circulation and vascular action, either by exciting the secreting structures themselves,

and their ultimately allied parts, or by depressing, impeding, or obstructing the functions of distant, and especially of other secretory organs, and from a superabundance in the blood of the elements of which the increased secretion is formed; *c*, or more or less *altered* from the healthy state, independently of diminution or increase of quantity; as when the conditions of life are modified otherwise than in grade, and when the circulating fluid is vitiated, either generally, or merely in respect of the greater abundance of some one element; *d*, or both *diminished* in quantity and *altered* in quality, owing chiefly to lowered as well as modified vital power, to changes in the blood, and to morbid vascular action or inflammation of the secreting organ; *e*, or, lastly, they may be both *increased* and *vitiated*, either from a morbid distribution, and alteration of vital influence and action, owing to the impression of causes on remote but related organs, or from irritation or excitement of the nervous influence of the secreting structure itself, by agents acting either exteriorly to the vessels, or interiorly, through the medium of the blood."

* * * * *

"From what has been stated, it will be evident that, although alterations of the secretions are often dependent upon vascular action in its various states, from augmented determination to inflammation and its results, and upon conditions of the blood, organic nervous influence has also a marked effect in generating them, and even in originating the vascular disturbances to which they have been most generally assigned by authors."

* * * * *

"The secretions which are elaborated by the intestinal mucous surface are often remarkably changed, both in quality and kind. Diarrhœa, dysentery, and cholera present extreme increase and alteration, not merely of these, but frequently

also of those poured into the digestive canal from the collatitious viscera, originating in the pathological states already adduced ; and illustrate the action of morbid secretions upon the surfaces with which they may come in contact. When the secretions are produced in large quantity and altered quality, whether from a modified and excited condition of the vital actions, or from both, or from these conjoined with an impure state of the blood, the effects following their passage over the villous surface are often very severe, and even disorganizing. Thus an altered state of the salivary fluid inflames and ulcerates the mouth, tongue, and gums ; and the irruption of a large quantity of acrid bile irritates the duodenum, excites severe vomitings and purgings, sometimes with spasms of the voluntary muscles, owing to the irritation of the visceral nerves acting upon the related spinal nerves ; and, in more chronic cases, when morbid secretion is prolonged, even excoriates the intestinal surface. *"A similar effect very probably is occasioned by the intestinal fluids themselves, as shown in DYSENTERY."*¹

If, as has been shown in the second part, or chapter, of this book, the normal nutrition of the entire organism, and not less that of its individual parts, is due to the ganglionic nervous system, then does it follow that *abnormal nutrition*, of whatever kind and wherever existing, must depend on the same portion of the nervous structure : the source, then, of cancerous, encephaloid, and melanotic diseases admits of an easy solution. Hypertrophy and atrophy, or, in other words, an excess and diminution of nutrition, are to be referred, the one to too much, and the other to too little, vitality—*i. e.*, too much and too little energy of certain parts of the ganglionic nerve-matter. Lepra (elephantiasis) is a form of hypertrophy, referable, like all other deviations in the distribution and

¹ See 'Lancet,' vol. i, p. 402, 1836-7.

arrangement of the elementary molecules (cells), to the great sympathetic nerve ; lepra, as observed among the dark races, is a hypertrophy of a specific kind, inasmuch as it is followed, after a lapse of time, by a positive disintegration—destruction, of the enlarged and affected parts ; but the separation of the phalanges of the carpal or the tarsal bones, and so on, is hardly compatible with anything else than a perverted and abnormal nutrition ; the effect of disease originating in, and kept up by, the organic nerves supplying the part or parts affected. Brett, in his ‘Surgery in India,’ remarks, in reference to the pathology of “lepra,” that “there seems to be a sort of stagnation in the process of nutritive vitality ;” that this is true of the later or advanced stages of this disease is certain.

If, as has been shown, also, in the second part, or chapter, of this book, the *solar ganglion* is so important a nervous centre, that any serious injury to the organ is most fatal in its consequences ; and if too, this, the principal of the many ganglia of the sympathetic, assisted by its accessory parts, preside over the development, growth, and maturity of the entire organism, then must the same organ, with like assistance, preside over, or affect its declining powers and decay. Upon this ground, we come to understand why the diseases, or more properly the *infirmities*, common or peculiar to advanced life are consequent on some altered action of, or in, the said ganglia of the sympathetic. The cerebro-spinal functions are observed to give way after long years of endurance (as if in disgust with their long experience of, and relationship to, the external world ; and as if commiserating the mere vital principle for the long and tedious connection existing between them, viz., the *animal* and *organic* functions), and hence the occurrence of the *paralysis of old age*, and of what is called “senile dementia.”

As life advances, the “promethean fire” created and

so long supplied by the organic nervous system to the brain and spinal cord, languishes, and the animal functions, therefore, become enfeebled. Thus it is that in extreme old age the individual presents the signs of a mere vegetative existence; and it is then as much as the ganglionic system can do to sustain the heart and lungs, including the organic apparatus subservient to the purposes of digestion, intact; and you may expect, therefore, that the cerebral and spinal functions have, in point of fact, retired from all participation in the fast-closing scene. But old age is now and then prematurely reached—this is the case with dwarfs and with congenital idiots; in such persons we observe the same facts, and to them a corresponding reasoning will apply. Moreover, the occurrence of a wasted limb, or of an atrophied testicle, will occasionally, and when not regarded as the effect or accompaniment of organic disease of the brain or spinal cord, &c., suggest to one the fact of *age* being altogether a relative term; and that a *premature decay* may affect not only the individual, but parts *only*, of the organism.

It may appear to some, that I have in the preceding observations made too free with the ganglionic nervous system, in so far as pathology is concerned. If, however, it be remembered, in the words of Dr. Andrew Combe, that “to *it* the bones, muscles, skin, nerves, blood-vessels, the lungs, the eyes, the brain, and all *other parts of the body*, owe their existence,—that to the organic functions must be referred “the formation, life, and support of every kind of structure,” then does it become difficult to understand how any kind of morbid action can be set up in the human organism, without the organic nervous system being very seriously concerned in it, either *primarily* or *consecutively*.

In conclusion, the ganglionic nervous system may be

said to constitute the bond of union, both in *health* and *disease*, between all the parts of the whole corporeal fabric—to link together organs the most remote, as well as those contiguous—to bind into one harmonious and dependent whole each and every tissue and structure we possess—and to create, by its arrangement and disposition, throughout the whole organism, such a never-ceasing round of sympathies and mutual reaction, that the study of it alone, either as physiologists or pathologists, assures us that, in the oft quoted words of Pope,—

“All are parts of one stupendous whole.”

APPENDIX TO CHAPTER III.

IF the foregoing opinions be correct—if the facts already stated rest on good ground—and the reasonings whereon such are based be legitimate and reliable—it follows that the *pathology* of the *excito-motory* system, as set forth by Dr. M. Hall, stands in need of some modification. If, in other words,—

1. The more complicated anatomy of the spinal cord, suggested by Dr. M. Hall, and sought for by Mr. Grainger, has not yet been realised.

2. If the mere sensory and motor nerves or roots are themselves sufficient to the integrity of all those phenomena called excito-motory, which emanate from the spinal cord; or, in other words, that there is no necessity for any distinct division of the nervous (spinal) system, for the production of the excito-motory phenomena.

3. If the exercise of the functions of the spinal cord is

due to the peculiar influence of the ganglionic nervous system, exerted on its organism.

4. If both the external and internal excito-motory phenomena, are alike dependent on the vital stimulus imparted by the great sympathetic nerve, and, in the former instance, through the instrumentality or medium of the medulla spinalis.

5. If such is the relationship between the great nervous centres, viz., the brain, spinal cord, and the solar ganglion, that the second (viz., the spinal cord), being at one time under the dominion of the first, *i. e.*, the brain, and at another time under that of the third, *i. e.*, the solar ganglion (being thus intermediate), will now manifest a cerebral or voluntary power (and this the result of consciousness, and, of course, volition), and then (the antecedent circumstances being dissimilar) display one of an involuntary, automatic, or instinctive, or excito-motory character; but this only, of course, when the organic nervous apparatus is in the ascendant, and the brain comparatively quiescent—or, in other words, when sensation (spinal) and motion, and not consciousness and volition (cerebral attributes) are in operation.

6. If the great sympathetic nerve is endowed with a specific and independent power, to which both the brain and spinal cord, and with them, of course, their functions are subordinate, then must it follow also, that “cynic spasm,” “crowing inspiration,” “certain forms of asthma,” “the act of vomiting,” “tenesmus,” “strangury,” “failure of the excito-motor power,” “chorea,” “paralysis,” “tetanus,” “hydrophobia,” “effects of strychnia,” “dysphagia,” “epilepsy,” &c. (Hall), will, as frequently as not, depend on some abnormal action originating in the organic nerve-matter, *i. e.*, the ganglionic nervous system. The *proximate* cause of these several disorders may be, and most

certainly is, located in the cerebro-spinal structures; but the remote or *centric* source or origin of the same must be not unfrequently none other than the *ganglial* nerve-tissue.

It strikes me as not a little strange that, whilst Dr. M. Hall affirms that in so far as the ganglionic nervous system is concerned, we are presented with "another open field, requiring renewed culture, and promising a rich harvest to the new labourer"—that whilst this gentleman so fully appreciates, as he does, the influence of the ganglial nerve-tissue over the growth, defective or otherwise, of young persons, and over the development and nutrition of infants; and, what is more, refers with so much point to the morbid effects of shock, physical and otherwise, to the "ganglionic system," as manifested throughout the body, and so especially by the interruption or cessation of the functions of the vital organs, as the brain, spinal marrow, heart, lungs, &c., that he should nevertheless ignore, so far as he does, the agency of the same portion of our organism in so far as the spontaneous occurrence of *diseased* action is concerned.

I cannot doubt, though incurring the risk of falling under the displeasure of the critic, and exposing myself, perhaps to the chances of being considered vain and presumptuous, but that the *physiology*, and not less the *pathology*, so long taught by Dr. M. Hall, and sought to be connected with the spinal cord in its two opposite states of being, *i. e.*, *health* and *disease*, have been, to some considerable extent, too hastily accepted in all their assumed completeness—that the same are destined to undergo some revision—that, in point of fact, the distinguished writer named has erred in isolating the spinal cord from the ganglial nerve-tissue as he has done—or, in other words, in dwelling on or in treating, though with great earnestness, perseverance, and ability, and even

success, of a series, and a very complicated series, too, of mere effects or consequences, regardless, in a measure, of their first cause or origin.

A short time since, Mr. Wm. Sedgwick published a small book 'On the Nature of Cholera as a Guide to Treatment.' It is intended "to illustrate the theory which refers the disease to functional disorder of the central parts of the sympathetic nervous system;" and it was with precisely the same object that I wrote the paper contained in the 'Lancet,' so long since as 1836, entitled "The Pathology of Fever and Cholera;" singularly enough, both Mr. Sedgwick and myself have expressed precisely similar views as to the *nature* and *seat* of cholera, so called.

The "theories" which "refer cholera to some local affection of the sympathetic nervous system," he arranges under *three* heads:

1. "Cholera, as the result of structural disease of the semilunar ganglia and solar plexus, and adjoining portions of the sympathetic nervous system."

2. "Cholera, as the result of functional disorder of the sympathetic nervous system, produced through the medium of the lungs."

3. "Cholera, as the result of functional disorder of the sympathetic nervous system, produced through the medium of the alimentary canal."

In order to prove his position, or, in other words, "to illustrate" his "theory," Mr. Sedgwick treats of "the general relation between cholera and other disorders which admit of being directly," and unequivocally, "referred to an affection of the sympathetic nervous system, produced through the medium of the stomach." Among "the several morbid affections of the body which appear . . . to offer some decided analogies with cholera, and which have the

advantage of being less obscure in their origin," Mr. Sedgwick recognises "the effects following a severe blow upon the epigastrium." Commenting on these, he remarks, and with great truth, "A parallel instance to the suddenly fatal effects following blows upon the epigastrium, has been occasionally observed in the cholera of India and elsewhere; when individuals attacked by the disease have suddenly become giddy, fallen down, and, after one or two slight efforts to vomit, have expired in a few minutes."

Proceeding with the argument, the author alludes to "the fatal consequences of drinking cold water when the body is heated," as affording a corresponding "illustration of the stomach receiving a *shock* from an *internal cause*, unconnected with any *evident* organic lesion. The death on these occasions, when it takes place suddenly, usually resembles very closely that which results from blows, &c., upon the epigastrium." After citing some instructive cases, which give weight to the foregoing observation, and which are gleaned from the writings of Drs. Currie and Rush, the author adds that, "the analogy derived from the primary effects of drinking cold water, in these cases, is supported by the secondary consequences which are sometimes observed to follow, in those cases in which the immediate shock has been recovered from, and which consequences are very similar to what occur frequently as sequels to cholera."

The most fastidious of us can hardly object to the following: "The effects of over-distension of the stomach, from food or gas, afford another illustration of the stomach receiving a shock, from an *internal cause*, which may prove fatal in the same way, by inducing collapse, without leaving any evidence of direct injury." . . . "Dr. Christison, who seems to have fully appreciated the importance of this

fact, remarks, that death from distension of the stomach "is the consequence, not always of apoplexy, but sometimes of an impression on the stomach itself; and he refers to two cases, which confirm this opinion."

However, in order to establish the *parallel* required, it is necessary to prove that this said *impression on the stomach* is reflected to the solar ganglion, or, at any rate, to the deep-seated ganglia of the sympathetic; but this is too self evident at this stage of our labours, to require comment.

Mr. Sedgwick treats at some length, and with much judgment, of the injurious consequences of "a shock to the gastric nerves," and to my mind, disproves, and most conclusively too, the assertion of Hennen, who has ventured on the opinion—"that the shock to the system in gun-shot wounds, &c., of the abdomen, is due to the impression being transmitted to the *spinal cord*."

That the fatal "shock," or *syncope*, or *collapse*, which attends, not unfrequently, on severe bodily injury, whether inflicted or not on the "stomach" or epigastric centre (the seat of the solar ganglion), *i. e.*, occurring to the extremities, for example's sake—cannot be referred to either the brain or the "spinal cord" (Hennen), is proved by the authority of Dr. M. Hall himself. This gentleman writes, at pages 127 and seq.—"According to the experiments of Le Gallois and Dr. W. Philip, to *crush* the brain or the spinal marrow enfeebls or arrests the circulation. I have discovered," he adds, "that the same effect is produced by crushing the limbs; and this is doubtless effected through the medium of the *ganglionic system*." In order to prove his position, Dr. M. Hall immersed frogs in alcohol and laudanum; the effect of this proceeding was to render the animals "insensible," and to *suspend the respiration*. When thus deprived of the cerebro-spinal functions, *i. e.*, of animal life, "the limb was crushed with a hammer," and "the circulation ceased instantly." Dr.

M. Hall adds—"the effect was precisely such as was observed by Le Gallois on crushing the spinal marrow."

* * * * *

"In an eel, in which the brain had been carefully removed and the spinal marrow destroyed, the stomach was violently crushed with a hammer. The heart, which previously beat vigorously sixty times in a minute, stopped suddenly, and remained motionless for many seconds. It then contracted; after a long interval it contracted again, and slowly and gradually recovered an action of considerable frequency and vigour. No experiment can more clearly demonstrate the effect of violence inflicted upon the system generally. The experiment is the more remarkable, because the connection and influence of the brain and spinal marrow were entirely removed. The organic structures must have been the medium through which the effect of the violence was conveyed to the heart."

"Similar events have occurred in surgical practice. A robust and healthy waggoner fell down, and the wheel of his heavy waggon passed over the abdomen. The beat of the heart was so enfeebled that the pulse could be scarcely felt. No reaction took place. The effect was perfectly similar to that of crushing a portion of the brain and spinal marrow. On examination, the ileum was found lacerated in two places."

"A man had his arm drawn in, and violently crushed, and torn off, by some machinery. The action of the heart failed, and never rallied."

"Every one will remember the melancholy accident which occurred to the late Mr. Huskisson. The tremendous vehicle passed over the thigh. The action of the heart failed, and the surgeon waited for reaction—for an opportunity for amputation—in vain."

Mr. Sedgwick has some very valuable and apposite remarks

concerning "the flux from the stomach and bowels" in cholera, and "its relation to collapse." He very wisely repudiates all idea of the dependence of the latter on the former symptom; but their general want of uniformity is, as a rule, sufficient in itself to establish the fact that the said *flux* and *collapse* stand in no such close relationship as *cause* and *effect*.

"It is not," writes Mr. Sedgwick, "by examining the evidence derived from cases of cholera occurring only in this country that this point can be satisfactorily determined, but by taking a wider range, and inquiring into the particulars of the disease as it manifests itself elsewhere. The histories of the first epidemic of cholera in India contain frequent allusions to cases in which the disease proved quickly fatal, before any vomiting or purging had occurred. During the outbreak of cholera in Bengal, in 1817 and the following years, it was observed that "in some rare instances the virulence of the disease was so powerful as to prove immediately fatal to life; *as if the circulation were at once arrested*, and the vital powers wholly overwhelmed. In these cases the patient fell down as if struck by lightning, and instantly expired. Others again sunk after making one or two feeble efforts to vomit, and drawing a long and anxious respiration. Some recovered from the insensibility produced by the first shock, and afterwards went through the course of the disease." Similar cases were also observed in the other Presidencies of India; and this supposed variety of the disease was distinguished at the time by the name of "Cholera Sicca."

Each succeeding epidemic of cholera has afforded examples of this fatal form of collapse, without any premonitory *flux* from the stomach or bowels. One of the most recent and remarkable instances on record of this sudden invasion of the disease occurred in the Black Sea fleet, off Baljik, in the autumn of 1854. "The first fatal case that occurred in the

British fleet," says Sir W. Burnett, "took place in the *Sans-pariel*, July 31, 1854. The man declared that he had been in perfect health up to the moment of his seizure. About four o'clock in the morning he was roused out of his sleep by severe cramps, and other unmistakable symptoms of cholera; and, in spite of a variety of remedial measures, he died about six o'clock in the evening." The disease on this occasion seems to have had a peculiarly malignant character; for, as Sir W. Burnett proceeds to relate, "the attacks in many instances were so sudden, that many men fell as if they had drunk the concentrated poison of the upas tree."

Although regretting that Mr. Sedgwick has found so little to advise concerning the treatment of cholera, I must add that this gentleman has made a very valuable contribution to the medical literature of this country, in the publication of 'The Nature of Cholera.' It does not appear that this book has received from the profession anything like the attention it so richly deserves.

CHAPTER IV.

THE preceding pages may be, I think, very properly followed by some *general observations* on the *treatment* of disease.

If, as it has been my endeavour to show, both *fever* and *cholera* are to be regarded as indications of either an altered or a diminished action of the ganglionic (organic) nervous system, it must follow that the primary object in the treatment of these affections should be the restoration of the same structure to its normal condition. With this view, a purgative plan of treatment is suggested. In both *fever* and *cholera*, the indications of treatment may be said to be these: 1st. The restoration of the altered or suspended functions. 2d. The support of the *vis vitæ*. The former is to be accomplished by the use of purgatives, variously combined, *and continued with discrimination*, until the excretions present a natural and healthy character. In febrile cases, many days, or even weeks, may elapse before this desired effect is realised; but in malignant cholera the same may be looked for in as many hours.

Free purgation, at the commencement of fevers, is the most likely plan to prevent the occurrence of typhoid symptoms. I have not unfrequently known the *fear* of debility beget so temporising a treatment, that the worst consequences have ensued. The persistence of disease must, of course, prove far more exhausting to the patient

than the employment of the necessary means for its removal.

In *malignant cholera*, I am in the habit, and have been since 1834, both in tropical and temperate countries, of administering a grain or a grain and a half of calomel, with some extract of colocynth and essential oil, as caraway and cinnamon, every hour or two. The more violent the purging and the greater the urgency of the case, the more active must be the remedies employed. Generally speaking, after four or five doses of the calomel and colocynth, the evacuations from the intestinal canal, although plentiful and perfectly fluid, will present a yellowish or bilious colour, when the medicine may be very properly discontinued; else the purging might become troublesome.

The support of the *vis vitæ* is to be effected in fever by the use of a light farinaceous diet, with, in some cases, broth, beef-tea, &c.; and in protracted cases, where the tongue is brown, by wine; and in *cholera*, so called, we must resort at once to stimulants, as *brandy* and *ammonia*. It has long been my custom to prescribe the following mixture for patients suffering from *cholera asphyxia*—

Rx Sp. Ammon. co., ʒvj;
Liq. Opii Seditiv, ʒ½;
Mist. Camphor. fort., ʒiv;
Aq. Menth. Pip., ʒiss, vel ad ʒvj.

Two table-spoonfuls are directed to be given to an adult, every fifteen or twenty minutes.

However, the treatment of cholera is a matter in every way deserving our attention, and one so important, that I may be permitted to introduce in this place some further remarks in reference to it, taken from communications of my own, addressed to the 'Lancet,' in 1854.

"It fell to my lot, in the very beginning of my medical

career (1834), and at a time, therefore, when my mind was scarcely in a position to be prejudiced by opinion or precedent, to visit Calcutta. I enjoyed the rare opportunity of witnessing the practice of the late Mr. Twining, at the General Hospital of that far-removed city; and there, and from him, I received the notion of the great utility of purgative medicines (free purgation) in the treatment of cholera. The fact was, moreover, the more forcibly impressed on my mind from the circumstance of having had much to do with this formidable malady during its awful visitation in 1832, at which time I was an assistant to my much esteemed friend, Mr. Charles Martin, of Bermondsey. The practical lessons learnt at Calcutta in 1834, I have not only never forgotten, but have not ceased to recognise as the essential basis of all treatment.

On my return from the Eastern world in 1836, I sent to the editor of the 'Medical Gazette' a paper "On Cholera," containing a report of many cases which I had met with in Bengal, China, and elsewhere, and each one of which had been treated successfully by stimulants and *purgatives*. It was doomed never to appear; no doubt the paper was anything but attractive in a literary point of view, and this very likely, in some measure, sealed its fate—apart from the seeming incompatibility of the mere *symptoms* of cholera with the treatment (free purgation) recommended.

"Strongly impressed with the very empirical notions entertained of the treatment of this disease, and with the fatal necessity of a sound and rational basis or principle in the selection of remedial means, I was induced to address you in 1842; and with precisely the same feelings dominant in my mind, I again take up my pen in 1854; and if any apology is needed for this intrusion on your time and space, it is the conscientious impression that the practice herein recom-

mended *must* be found on trial not less successful in other hands than it has proved in my own.

“The indications of treatment are—

“1st. To support the *vis vitæ*.

“2d. To restore the suspended functions of the organic apparatus—*i. e.*, the thoracic and abdominal organs.

“3d. To be on the look out for particular symptoms.

“With regard to the first named, it is to be attempted by the employment of stimulants externally applied and internally administered; the hot bath, mustard sinapisms, flannels wrung out in hot water, and afterwards wetted with spirits of turpentine, and applied to the extremities and abdomen, &c., or other artificial means of warmth, must be assiduously persevered in; and, at the same time, their operation must be assisted by a liberal use of ammonia or brandy; the latter may be given somewhat diluted with hot water.

“To quote again from my former paper in ‘The Lancet’ for 1842—‘I am in the habit of prescribing a mixture containing aromatic spirits of ammonia, strong camphor mixture, and mint-water, to which, for the relief of the vomiting, I add more or less of Battley’s solution: thus—compound spirit of ammonia, one drachm; Battley’s solution, six minims; camphor-mixture, six drachms; mint-water, three drachms. I direct this to be taken every fifteen or twenty minutes, and continued according to circumstances. . . .

. . . Whilst such means are being had recourse to for the fulfilment of the first indication of treatment, the second—viz., to restore the suspended functions of the organic apparatus—must not on any account be overlooked. With this view, I invariably accompany the treatment above described with the administration of calomel and extract of colocynth, united to some essential oil or capsicum: thus—submuriate

of mercury, one grain and a half; compound extract of colocynth, five grains; oil of carraways, two minims. This pill I direct to be taken every hour or two, according to circumstances. Within these few weeks, I have had under my care five cases of cholera of the worst description, and in neither was it necessary to give more than five doses of the pill in so quick succession, although it was found indispensable to the entire restoration of the abdominal secretions to repeat the pill from time to time during the two or three days subsequent to the attack.

“The first effect of the medicine is the appearance of bilious matter in the stools, when it is generally proper to discontinue its further employment, else the purging may become troublesome, though the evacuations will have lost their peculiar and abnormal character.

“In certain cases occurring among the native population at Ceylon, and during my late sojourn there (from the year 1844 to 1849 inclusive), I was in the habit of prescribing, alternately with the above purging pills, a draught composed of castor oil and spirits of turpentine, of each about four or six drachms, to which one or two drops of croton oil were not unfrequently added. I had much confidence in this formula, inasmuch as it acted well, both as a stimulant and a purgative.

“Purgative medicines, when given in *cholera*, so-called—*i. e.*, when judiciously given—never act as purgatives, but they restrain the *diarrhœa*, and effectually check the intestinal discharges; they act as restoratives to the normal character of the secretions, and so facilitate the formation of healthy fecal matter. Hence it is they are of so specific a value in the treatment of this disease.

“On the third indication of treatment I need not dwell.

“I cannot, however, close this communication without call-

ing your attention, and that of your many readers, to the recorded opinions of Mr. John Jones, of Derby. This gentleman, in a letter addressed to the 'Association Journal,' dated Nov. 10th, 1852, has confirmed in every particular my own views and opinions concerning the treatment of cholera by *purgatives*, and particularly by 'calomel and colocynth.' 'Under this treatment,' writes Mr. Jones, 'a manifest amelioration of all the symptoms speedily occurred; the vomiting became less urgent; the alvine dejections, instead of being more frequent, as might, *a priori*, be expected, as the result of the purgative pills, become invariably less frequent, less copious, of greater consistency, and in a few hours feculent and mixed with bile. When these gratifying changes in the evacuations occurred, speedy and uninterrupted recovery usually followed.'

"I need not add how great was the pleasure I derived from the perusal of Mr. Jones's letter, confirmatory as it is, in 1852, of my own experience, as explained in the columns of 'The Lancet' just ten years previously. I do hope that in the treatment of cholera medical men will, ere long, abandon those empirical proceedings which now too frequently characterise their practice."

The following is an extract from a letter sent to 'The Lancet' in September, 1854; being a reply to certain strictures which that Journal contained on the treatment of *cholera* by *castor oil*, as advised by Dr. Johnson:

"However, if you will permit me, I will endeavour to show *why* and *how* it is the purgative plan of treatment, as advised and adopted by Dr. G. Johnson (for to this especially do your remarks seem to apply) has fallen short of its first promises. Dr. Johnson tells us that he relies principally on *castor oil*, as a purgative, 'the *only* adjuvants employed being sinapisms to the abdomen, hot bottles to the feet, and dry friction.' In Dr. G. Johnson's letter to

the 'Medical Times and Gazette,' he writes—'the largest amount of mortality has occurred in the practice of those who have given freely either opium or alcoholic stimulants.'—'We most carefully avoid opium and brandy until the period of collapse is safely past.'

"Now both Dr. G. Johnson and Mr. L. F. Crummey, whose 'Practical Observations on Cholera,' at p. 178 of your current volume, are of much value—have been and are (I think) much too mindful of their mere *drugs*, and not sufficiently anxious as to the broad *principle* which should actuate the practitioner, when engaged in the treatment of '*cholera*.' The '*new*' (?) *treatment of cholera*, as it is called—THOUGH VERY ERRONEOUSLY—takes cognizance rather of 'castor oil' than '*purgatives*,' or, at the most, of *castor oil* and *turpentine*; the latter has been employed *once* only by Dr. G. Johnson, combined with Ol. Ricini, though advised, in a very general way, by Mr. L. F. Crummey. I feel confident that so soon as Dr. G. Johnson shall employ *castor oil* as an auxiliary purgative, and nothing more, and shall call to his aid the opium and brandy he now avoids, then will his success be greatly enhanced; and I doubt not the remarks of yourself be very materially modified. Dr. Ayre's treatment of cholera by small and frequently-repeated doses of *calomel* is, like Dr. G. Johnson's castor-oil treatment, open to objections. Dr. Ayre takes cognizance of *calomel* as a mere specific; he does not recommend it as a purgative; I am, nevertheless, disposed to believe that small doses of *calomel* are of benefit only when such produce a purgative action on the bowels; and this would occur very much more frequently if the medicine were given in larger quantities, as ten or fifteen grains for a dose. But doubtless the remedial efficacy of *calomel* is greatly assisted, when given in combination with the extract of colocynth, &c., as is herein advised.

“ Each organ (abdominal) concerned in the vital functions being on the verge of extinction or death, demands an especial *stimulus*; hence the necessity of not only castor oil or calomel, but of *turpentine*, *croton oil*, and *colocynth*, and so on. I would beg particularly to remind Dr. Johnson that *castor oil*, and not less the whole of the purgatives of our Pharmacopœia, are more likely to produce the specific and required action in the course of the *primæ viæ* when the *vis vitæ* are supported, as best they may be, by *brandy* and *ammonia*, &c., than under other circumstances; and that ‘alcoholic stimulants,’ which this gentleman so very strongly condemns—as does also Dr. Ayre—when given PRUDENTLY, not only limit ‘the period of collapse,’ but do *not* cause the ‘consecutive fever’ of which very unnecessary fears are entertained: moreover, that, these same ‘alcoholic stimulants’ very materially accelerate the good effects of ‘sinapisms to the abdomen, hot bottles to the feet, and dry friction.’

“ I hope and trust that neither the calomel treatment of Dr. Ayre, nor the castor-oil treatment of Dr. G. Johnson, will much longer add to the many *exclusive* systems of treatment of cholera; but that these mere aids or *parts* of a general and *purgative* treatment may, ere long, receive their due acknowledgment—but nothing more than this.”

Before dismissing this subject, I would ask the reader to look to the ‘Diseases of Bengal,’ by Twining (1835); in this work he will find recorded the particulars of many cases of *cholera Asiatica*—and these were treated, and successfully treated, by purgatives. In a word, the late Mr. Twining chose, invariably, the purgative treatment, and felt that it was adapted in an especial manner to the requirements of the disease; but he did *not*, like Drs. Johnson and Ayre, confine himself to *one* drug—to the exclusion of many more; nor did he, like the first named, reject the aids to be derived from stimulants, as ammonia and brandy.

In fever, as in cholera, care must be taken lest the patient sink from the exhausting effects of disease, occurring to the organic nervous system. In fever *quinine* may be given, more or less early, the stomach and bowels having been rid of all offensive matters, and the tone of the excretory organs, as the liver, primæ viæ, skin, &c., being restored, or rather relieved of the shock consequent on the first invasion of abnormal action. Doubtless, there is this peculiarity in febrile cases, viz., the administration of quinine cannot be insisted on at any given time, or on a particular day, during the progress of the attack; each case must rest on its own merits. Of this there can be no doubt, that all idiopathic febrile affections not only bear quinine at a much earlier period of their course than formerly, but that the well-being, even safety, of patients demand this remedy. Twenty years ago, the administration of quinine (bark) in fever was a more delicate question than now—that is to say, it was not so easy a matter then to hit on the precise time or day when this medicine would do good, and *not* aggravate the symptoms of the disorder, as at this time. That rule is a safe one which recognizes the propriety of the early use of this very valuable drug; and that this remark applies equally to the fevers of tropical and temperate climates there can be no question.

At Ceylon it was, and I have no doubt is, the practice to give quinine on the very first accession of fever. Having administered a full dose of Pulv. Jalap. co., and well sponged the skin with warm or tepid water, the Sulph. Quin. was commenced: it was usual to give it in combination with Pulv. Jacobi and Hydr. c. Creta. Two grains of each of the first named with one of the last was the formula in general use, and very efficacious it was. Should the scalp be hot and the face flushed, and, furthermore, should the patient suffer from active delirium, a few leeches may be

applied to the temples or behind the ears; but in this case, there is not the slightest reason or necessity to do else than continue the quinine; on the contrary, its omission will be sure to throw the patient back, and do him much harm; that is as a general rule. The preceding is hardly less applicable to fever cases in this country than to the same occurring within the tropics. Within a comparatively short time, I have been required to see two cases of protracted, *i. e.*, low (idiopathic) fever; whilst in one, quinine and stimulants were being given, in the other quinine only had been omitted. The first patient alluded to, a young gentleman, *æt.* 20, I found mumbling and muttering to himself in a most confused and incoherent manner; the pulse was rapid and feeble, and the powers of life were somewhat reduced. Countenance anxious and oppressed; tongue dirty, though moist; breath fetid in the extreme; skin hot and dry; abdomen full, hard, and tympanitic; urine scanty, high coloured, and full of uric acid deposit. There had been no satisfactory action of the bowels for something like three days. Here was a case in which *the bowels had not been rid of offensive matters*, and in which *the tone of the excretory organs, as the liver, primæ viæ, skin, &c., had not been duly relieved of the shock consequent on the first invasion of abnormal action*, by the judicious use of purgative medicines. I advised, therefore, a full dose of calomel, to be followed by *Haust. Nigr.*, or *Ol Ricini*. This treatment relieved him much, and after a repetition of the same means, it was found necessary to resume the quinine; this, with a careful dietary, had the desired effect; the patient recovered. The second patient was in extreme danger—the symptoms ran high; in point of fact, the skin was so hot, and the delirium so frequent and persistent, and all the usual indications of fever so continuous, that the medical gentleman in attendance doubted the propriety of giving bark in any shape. It is sufficient to add,

that under its use our patient made a rapid recovery; the young lady alluded to took quinine suspended in the Mist. Effervesc.—a grateful mode of administering this drug in febrile disorders.

It will be remembered that I have already treated of *apoplexy* as of two kinds, the one *cerebral*, the other *ganglionic*. Of the treatment of the former I have nothing to observe. As regards that of the latter—inasmuch as there is no sanguineous effusion to be anticipated—bleeding is of use only to diminish the quantity of blood, and thereby the better enable the enfeebled heart to continue its action; as well as to relieve the pulmonary congestion. I once met with an interesting case of *ganglionic apoplexy* in a little boy. I was summoned in great haste to him, and on arriving at the house I was told by the parents of the child that as he was, evidently, dying, I need not trouble myself. The little fellow was lying in his mother's lap, gasping deeply for breath; the eyes were partially closed, the countenance livid, and the pulse scarcely perceptible. Seeing me take a lancet from my pocket, those present, without an exception, exclaimed against my doing anything; so positive were they that my little patient was doomed. However, I did directly open a branch of the temporal artery and abstracted a wine-glassful of blood. The respiration became immediately tranquil. I desired a bystander to put the point of his finger on the puncture, to prevent any further loss of blood; and proceeded then to administer some diluted brandy. In fifteen or twenty minutes, my patient was not only conscious, but in a state of convalescence.

The following is an extract from a communication on "Effusion into the Brain," addressed to the editor of the 'Lancet,' dated April 6th, 1843; and inasmuch as it contains the details of the above case, I may be excused bringing them thus to the attention of the reader: "In

the spring of 1840, being then in private practice in the suburbs of London, I was hastily summoned to the assistance of a child, about eighteen or twenty months old, who, I was told, had been suddenly seized with a 'fit.' It was lying in its mother's lap, apparently dying. The surface of the body was moderately warm, but covered with a clammy perspiration; the countenance was injected and livid, the pupils dilated, eyes fixed, and the eyelids partially closed; the mouth contained a quantity of frothy saliva. The respiration was hurried and oppressed, and the pulse rapid and feeble. The parents of the child, and two or three other persons who were present on my arrival, felt so assured of its immediate death, that I was requested not to interfere in any way. I had much difficulty to induce the parents to forego their resolution. Having only two or three days before lost a child under very similar circumstances, at Camden Town, I resolved on a different kind of treatment to that I had then adopted; that is, I chose to open a branch of the temporal artery, rather than wait the issue of a modified procedure. I abstracted very little short of a wine-glassful of blood; and then, having desired the father to press the bleeding orifice with the point of his finger, I administered, by means of a tea-spoon inserted into the pharynx, a little brandy and water. The excellent effects of the treatment became immediately apparent. I was hardly less surprised than those about me. The surface of the body became warmer, the respiration natural, and the pulse normal. My little patient was presently conscious, though much disposed to sleep. I called after some four or five hours, and found the child comfortable, and quite rational. A purgative was given. The next morning it was brought to my residence quite well."

In a former part of this book allusion is made to a case of "ganglionic apoplexy" which occurred in an insane female,

an inmate of the Hanwell Asylum. The depression which characterised the attack was as distinctly marked as in that of the child above narrated. *I relied on gentle stimuli only*; but it was a source of regret to me, after the fatal termination of the malady, that I had allowed the heart so to struggle on with an amount of blood it could not, as the event proved, dispose of, or urge onwards in its course. Probably, had some six or eight ounces of blood, or perhaps *less*, been abstracted—had the quantity of the circulating fluid been diminished ever so little—*then* the heart might have righted itself, and the vital powers have been restored; in other words, the organic nervous system have recovered its normal condition, and the apoplectic symptoms have declined.¹

¹ In the treatment of “apoplexia levis,” of the old writers, there would seem to be *two* important items to be kept in view; one has reference to the relief of the *asphyxy* (threatened suffocation), the consequence of an impaired or atonic condition of the heart and its great vessels, whereby the pulmonary circulation is greatly impeded; the other to the support of the *vis vitæ*, already much below par. In any given case, the *asphyxial* or *syncopal* symptoms will preponderate; although, both may be present. The practitioner will then choose his remedies accordingly; and even combine them, to meet the peculiar circumstances which may obtain.

The following few words are from the pen of Dr. Copland; they relate to the “treatment of the depressed states of apoplectic seizures.” It will be apparent from the particular details I have given of the symptoms, causes, and pathological states of the disease; first, that much depression or exhaustion of the vital powers of the brain exists in some cases throughout the attack, even rapidly terminating in death without any effort at vascular reaction, particularly when this state is mistaken, and treated by excessive vascular depletion, or by other depressing remedies; and, second, that this depression is often analogous to concussion of the brain, owing to the extent of the local lesion, and consequent vital shock; and, like this result of external injury, is frequently followed by reaction of the heart and arteries, when the lesion constituting the seizure is not so great as to overwhelm the powers of life altogether, and thus to produce rapid dissolution.

“It is owing, in my opinion, either to the employment of too large blood-

The very same principle of treatment applies equally to apoplexy *and* epilepsy. In both forms of disease it used to be considered that the lancet was the only remedy; but at this time it is confessed, that not only do apoplectic seizures from time to time, *i. e.*, occasionally, *not* demand bloodletting, but that in the treatment of epilepsy it is, *as a very general rule*, indispensable to employ tonics, taking the greatest care to avoid anything like an approach to a lowering or an antiphlogistic plan. Within the last four months¹ I have been consulted in two cases of protracted epilepsy; and although each one was associated with well-marked indications of deficient vital energy, yet did occasional local bleedings and low diet constitute the plan of treatment pursued. Both patients were put on a liberal dietary; and one of them was allowed wine daily. The first was very materially relieved by the discontinuance of the leeches, and by the better living, but the second was completely cured. The fits, from being repeated some four or five times in the twenty-four hours, as they were on my seeing him, became less and less frequent; and, after the lapse of two months, they had entirely ceased. The lad was restored to perfect health. A comparison of this patient's wretched and emaciated form when I first saw

lettings in such cases, to the having recourse to them at all in others, or to practising them without sufficient regard to this early period of the seizure, and before the occurrence of reaction—the time when they are imperatively called for—has supervened, that the practice has disappointed many who have adopted it, and led others to employ an opposite mode of treatment in an equally exclusive, and hence dangerous, manner. The judicious use of *gentle stimuli* during this stage of depression will have the effect in some cases of bringing about a moderate reaction, when death would be the result of other means; and, by diminishing and shortening the stage of depression in others, and thereby lessening the congestion of the capillaries of the brain, that inordinate degree of arterial action consequent upon the obstruction, and indirectly produced by it, will be prevented.”

¹ This was written in 1845.

him, with the robust and muscular appearance which he presented after some ten or twelve weeks, suggested to my mind the idea that the "fits" had been produced by *starvation*, or something very like it.¹

¹ I think it right to observe here, that I am far from inclined to give my assent to the views and opinions of those practitioners (Dr. Radcliffe and Mr. Solly, amongst others) who deny that bleeding is ever required in *epilepsy*. I have lived too many years under the same roof with epileptic patients, and have realized too much of their personal histories and sufferings, to doubt that *bleeding* may be, *now and then*, and as the rare exception to a very general rule, practised with vast benefit. *I mean, more particularly, during the paroxysm.* As I write, I recall to my mind four patients, one an inmate of the Hanwell Asylum, one of the asylum at Colney Hatch, and two more private patients (gentlemen), whom I bled at the time of the *fit*; and with the effect, as I believe, of saving their lives, for the time being. The first died some two years after the attack, from *general paralysis*; the second is, so far as I know, alive now; the third died five years after the attack, from phthisis; and the fourth is, I believe, in health, and free from the disease (epilepsy). When epilepsy proves fatal, *i. e.*, during the paroxysm, it is, as it appears to me, from either pulmonary congestion (suffocation) or laryngismus, or the effusion of blood on, or into the substance of, the brain, or from "*epilepsia syncopalis*," (Hall). The loss of a few ounces of blood will probably remove the danger consequent on the first (the remedy acts by not only reducing the volume of blood within the lungs, but by relieving the heart, or, which is much the same thing, diminishing the quantity of blood which has to be forced onwards in its course), and tracheotomy will relieve the second. The effusion of blood on, or into the substance of, the brain, can only be prevented—in certain individual cases, where the disorder is quite recent, the general health of the party attacked previously good, the *fit* severe and continuous, and the head symptoms (coma) well marked—*by a full bleeding*. In "*epilepsia syncopalis*" stimulants are, of course, indicated. In those cases, where the power of swallowing is lost, turpentine in the form of enema may be employed. But as in apoplectic seizures, so in epilepsy, all cases are more or less of a mixed character; and hence the inutility of any special or exclusive treatment.

Within the last few months an insane gentleman came under my care, who had been treated after the old plan of low diet, very constant seclusion, &c. His appearance was that of one half-starved; he was shockingly emaciated, very irritable, and childish. Under the influence of good food, air, and exercise, he became, ere long, plump and well nourished; his mind improved with his body. The *apparent* effect of this change in his mode of life, and of his better

It seems not unlikely, that the erroneous views entertained even to this day as to the treatment best adapted to the relief both of apoplexy and epilepsy, have their origin in that not over-wise belief, which locates (invariably) the first or principal cause of the disorders named in the cerebro-spinal, rather than in the ganglionic nervous system; unmindful of the fact that the morbid condition of the said brain, &c.—as indicated by the prominent symptoms of the case—is, or rather may be, but the consequence of mischief more deeply (centrically) seated.

The observations contained in the last chapter imply, of themselves, that purgative medicines are of great value, and indispensable to the successful treatment of what are called nervous disorders, as chorea, neuralgia, hysteria, tetanus, hypochondriasis, &c. Sir C. Bell is said to have been very successful in his treatment of the *neuroses*; and it is on re-

feeding, was *epilepsy*; this epilepsy continued from time to time, in spite of medical treatment (gentle purgation) and the discontinuance of Bass's ale—until he, falling in a fit, received an incised wound on his cheek and nose, whereby he lost some ten ounces of blood. Strange to say from the date of this occurrence the epilepsy never appeared.

It is as well to remember that among persons long afflicted with epilepsy, and whose death has been attributed to the same disorder, it is very common to find effusions of blood within the cranium. When these are *not* found in fatal epilepsy, then is death, for the most part, due to either *asphyxia* or *syncope*, to “asphyxial or syncopal symptoms” (Radcliffe). Moreover, so far as my experience went at the asylums at Hanwell and Colney Hatch, I conclude that the chronic meningeal disease, or disorganization, which so commonly attends on epilepsy, although, more generally than otherwise, an *effect* of morbid sensibility occurring to the cerebral substance, tends to maintain and aggravate the *fits*; and from which something like twelve per cent. of the inmates, of the large establishments named, suffer. And, what is a material point, in some of those cases where, after death, the appearances were such as to induce one to suppose that there had been recently an aggravation of meningeal disorder—asthenic inflammatory action—the mental disorder *and* the epilepsy had become greatly worse, some days preceding dissolution. These facts will be taken for what they are really worth, and nothing more; they are so intended.

cord that he attributed his success to *purgation*. Of course, it is not meant that he practised empirically, or, what is the same thing, purged all his patients alike, or equally; but rather that he looked critically into the state of the *primæ viæ*, and never allowed a faulty or depraved secretion to go undetected; and having detected it, he made a judicious selection of his remedies, and, what is more, adapted them, in so far as force and frequency are concerned, to the peculiarities and requirements of individual cases. I will venture to add, moreover, that Sir C. Bell was much too accomplished a practitioner to deny his patients the benefits to be derived, at the right time and in the right place, from local bloodlettings—from the internal use of tonics, as iron and quinine—from the employment of opiates—and from the adoption of that physical régime so essential both to the restoration of health and to its preservation.

Whatever importance is due to the labours of Prout and Golding Bird, and others of the same school—and however highly we may be disposed to prize the zeal and ability which have added so much to our knowledge of the now popular subject of urinary pathology—still it should be remembered, that the idea of looking on the human body as a mere storehouse of chemicals, and as one vast laboratory, in which are concocted so much or so little urea, uric acid, inorganic salts—so much or so little uric oxyde, purpurine, or oxalate of lime, &c.—is not altogether correct. If the presence of acids or of salts, of xanthine or of cystine, &c., in the urine is to be regarded as a mere exponent of chemical action occurring to the human organism; and this independently of the vital processes in such unceasing operation through the whole body, it may be that the practice of medicine will run some chance of a falling off. That there exists in some minds a very manifest preference for the *chemical* over the *vital* treatment of

disease, cannot be doubted. Such practitioners of the healing art would seem to require to be reminded, that whatever chemistry might reveal as to the condition of the urine, whether in a state of health or disease, that this depends, altogether and exclusively, on the operation of the *vital affinities* occurring to the stomach, or more directly to the kidneys; that, in point of fact, the existence of morbid urine is due to an interruption of these same *vital affinities*, as they are carried on in the internal organs, and principally in the liver and stomach; and that to content themselves with *chemical* remedies, so to speak, is to deny their patients a fair chance of recovery.

The foregoing views may be well illustrated by a reference to the treatment of *hypochondriasis*. Some few years ago, when the late Dr. Golding Bird brought out the first edition of his able work, entitled 'Urinary Deposits, their Diagnosis, Pathology, and Therapeutical Indications,' men of a peculiar mental bias were won over to the belief that the *nitro-muriatic acid* was to realise the all-sufficient panacea for *hypochondriasis*; that the use of this medicine and the persistence of melancholy, of whatever hue, were incompatible, and could in no wise obtain. Every hypochondriac or melancholic was sure to have his or her urine filled with crystals of oxalate of lime. *Oxaluria* was the disease of all others which was to yield to this all-potent and magical acid. Need I add, that Dr. Golding Bird never intended to make such conversions—his genius was not of that quality; but it is the fate of the *hero*, if we are to believe Carlyle,¹ to give birth to unsuccessful imitators. The doctrine espoused by these, "of a peculiar mental bias," was based on a shadow—and it has declined; G. Bird's opinions of hypochondriasis and of its treatment remain intact. What these are the following quotations from his 'Urinary Deposits'

¹ See his 'Heroes and Hero Worship.'

will explain: "That some very slight disturbing causes influencing the assimilative functions, will give rise to the presence of oxalate in the urine is perfectly true, even when the food taken does not contain oxalic acid ready formed, but this is generally a temporary change, and soon disappears on the removal of the exciting cause."

* * * * *

"It is impossible to connect any definite set of symptoms with *all* cases in which oxalate of lime appears in the urine; indeed, persons will often go about their ordinary duties in apparently fair health for a long time, and yet be constantly excreting the oxalate of lime."

* * * * *

"Persons affected with the form of disease referable to this class are *generally* remarkably depressed in spirits; their melancholy aspect has *often* enabled me to suspect the presence of oxalic acid in the urine. Sometimes a peculiar lurid, greenish hue of the surface has been observed, but more generally the face has the dark and dingy aspect so common in some forms of dyspepsia, in which the functions of the liver are deranged. They are generally much emaciated, excepting in slight cases; extremely nervous, and painfully susceptible to external impressions; often *hypochondriacal* to an extreme degree, and in very many cases labour under the impression that they are about to fall victims to consumption." * * * "Well-marked dyspeptic feelings are always complained of."

If we will take the trouble to look to the cases of *hypochondriasis*, as reported by Dr. G. Bird, cases in which the oxalate of lime *was* found in the renal secretion, we shall not discover that this much lamented and accomplished physician administered the NITRO-MURIATIC ACID else than as an *auxiliary*. The "illustrative cases" are eight in number; and each one demonstrates the great importance at-

tached to the judicious and discriminating use of purgative medicines. Case 1 took two grains of "Ext. Aloës pur." each night, *and* "an occasional aperient. Case 2 took a gentle mercurial aperient, with P. Ipecacuan. o. n. Case 3 took Pil. Col. c. Hydr., ℥ss, o. n. Case 4 took Pil. Col. c. Hydr., ij, o. n.; Pulv. Jalap. co., ʒj, o. m. Case 5 took "Pil. Col. c. Hydr., ij, o. n.," and "Pulv. Rhæi Salin., ʒj, mane." Case 6 took "Pil. Hydr. Chlorid. co., gr. v, o. n." Case 7 was one due to over-lactation, and was cured by acids and bitters, and the discontinuance of nursing.

Without venturing to call into question the valuable properties of either the nitric or nitro-muriatic acid in cases of hypochondriasis associated with *oxaluria*, yet does it appear to me that this medicine, if given to the exclusion of purgatives, to say nothing of tonics and sedatives, &c., cannot be expected to prove of any lasting service; and this upon the principles above explained.

I had under my care, not long since, an aggravated case of hypochondriasis, one realising the characters, perhaps, of a confirmed *melancholy*; the disease lasted from first to last about three years and a half. Although the urine was frequently examined, with the view of discovering the presence of oxalate of lime crystals, such were not found more than once; then in a very small quantity, and as a mere accidental circumstance. The patient alluded to suffered greatly from dyspepsia; he had taken an enormous quantity of purgative medicine, *in occasional strong doses*, but with temporary benefit. His recovery seems due principally to a nightly dose of aloes; under its use the bowels were relieved twice or thrice, the evacuations being free and bilious.

It needs hardly to be added, that the *medical* treatment of the nervous, or the *hypochondriac*, can hardly be expected to do a great deal, if the best attention be not given

to the *physical régime*; air, exercise, mental diversion, the warm and shower bath, friction of the surface of the body, attention to dress, and so on, are indispensable to complete success.

It will not be denied, that many individual diseases of the body pass by gradations, more or less insensible, into each other; thus, *hypochondriasis* and *cardialgia*, so called, have each of them symptoms common to both. The fact is, they are forms, or rather modifications, of the same special affection, and this is located in the ganglionic nerve-tissue (that entering into the formation of the whole or of parts of the *primæ viæ*), and probably in the ganglia of the sympathetic themselves. As may be expected, the name employed in any given case will depend on the prominence or intensity of one or more symptoms. The spirits may or not be greatly depressed in “*cardialgia*;” when they are so, a patient is more likely to be said to be suffering from *hypochondriasis* than from *cardialgia*. At page 299 of Dr. G. Bird’s ‘*Urinary Deposits*,’ there is recorded a good example of ordinary “*cardialgia*,” but inasmuch as there was present a constant “vomiting of thin yeast-like matter,” the disorder is named “*irritative dyspepsia*.” However, the great point is not so much the name as the seat and nature of the disease we are called on to treat; these latter will alone reveal the *principle of treatment* to be kept in view.

As regards the treatment of *cardialgia*, I may remark that the lady alluded to in a former part of this book was effectually relieved of her “faintness in the stomach”—which, by the way, was the mere indication of an atonic condition of the *primæ viæ*, brought about by errors in diet, sluggish habits of life, and the imprudent use of brandy, opium, tobacco, and the like—by the daily use of pills composed of Ext. Aloës Aq., Ext. Hyos., and Ext. Nucis Vom.; with

Haust. Nigr. p. r. n. A liniment of Ol Croton., with Lin. Sapon. co., was applied to the epigastrium. The diet was regulated, and air and exercise enjoined.

I have found a combination of Argent. Nit. and P. Opii, in small doses, of much value in one case of *cardialgia*, which had resisted various means of treatment, and these in the hands of most able practitioners. The female alluded to wore an opiate plaster over the scrobiculis cordis. Pil. Hydr., c. Ext. Hyoscyam, was given each night for some time.

A combination of sedatives and antispasmodics is of much use,—as the Tr. Hyos. and Sp. Æther. S. co., with Mist. Camp., or the Tr. Op. Comp. in Aq. Menth. pip., and Inf. Valerian. Pills of Zinci Sulph. and Ext. Hyos. have been recommended.

As local applications, chloroform, mustard, Acet. Canth., Tinct. Opii, are found serviceable. A gentleman suffering from hypochondriasis, who was much distressed, from time to time, by “a strange, fluttering, windy sensation” at the epigastric centre, and which, occurring about bedtime, or during the night, prevented him from sleeping, derived no inconsiderable relief from the application, to the affected part, of a large sponge well filled with iced water.

Inasmuch as *cardialgia* is more frequently than otherwise complicated, if not caused, by *dyspepsia* in some shape or the other, by some atonic condition of the digestive apparatus or a portion of it, or by the presence of some irregular or faulty secretion—biliary, or pancreatic, or gastric, &c.—it is of very little use our expecting much from either local or general means, from opiates or antispasmodics, or anything else, so long as we fail to correct such “*dyspepsia*,” or “*atonic condition of the primæ viæ*,” or “*faulty secretion*,” &c., by appropriate remedies; having done so, but not otherwise, we may have much confidence in the means above enumerated.

Neurosis, or “neuralgia of the coeliac plexus,” *i. e.*, *cardialgia*, is, of course, met with in a pure and unmixed form, and uncomplicated with indigestion — taking that word in its largest acceptation. As such it occurs very commonly to chlorotic girls; the medical management of whom speaks for itself. The administration of the citrate of quinine and iron, or of the ammonio-citrate of iron, should form a part of our treatment, recourse being had, at the same time, to sedatives, antispasmodics, local applications, &c., according to circumstances. I have known arsenic do much good in a case of *chlorosis*, in which great epigastric distress and very urgent debility were present. An unmarried lady, now under my care, derived very marked benefit from the Liq. Pot. Arsen.; this was prescribed for the relief of long-standing *psoriasis*; but under its use she lost, to a very considerable degree, not only her chlorotic appearance, but the “neurosis” which she had so long endured.

Although willing to admit that Hamilton and Abernethy may have carried the purgative treatment of disease — and of the *neuroses* especially — a little too far, yet I cannot allow the present opportunity to pass by without expressing my fears that we are becoming too “expectant” in our treatment of disease; *i. e.*, rather more inclined than we should be to rely on nature’s curative efforts, to the neglect of *art*. Doubtless, some twenty or thirty years ago, practitioners, not unfrequently, erred in doing too much; but at this day do not some among us act injudiciously in withholding from our patients the necessary *treatment*? I read some months since in one of the weekly (medical) journals that *active purging* had become obsolete, that it was not demanded by the present “type of disease.” That this is a very fatal error, is to my mind undeniable; I can imagine no one assertion more calculated to bring medical science into disrepute. I should be sorry to find myself or those whom I love under the care of

that physician or surgeon who could venture on an opinion such as the above. That the present "type of disease" does not require, nay, more, will not *bear*, the same lowering treatment, viz., the bleeding, the purging, the puking, the starving, which used to be pursued, in certain cases, is MOST TRUE; but to assert that the *lancet* is to be altogether proscribed, and purgation fall into utter disuse, is to commit a capital offence against common sense *and* common experience. We must *not* run from one extreme to another; in other words, in giving up the extravagance of *allopathists*, we must avoid the nonsense which characterises the *homœopathists*; however, the tendency of *the medical mind* in 1857, is, as it appears to myself, *to run from one extreme to another*. Let this same tendency but halt in its mad career—let it but possess itself of the safe footing to be realised at a point somewhere intermediate, but locate itself in the right place between the two extremes above indicated—then will all be well.

The following quotation from the pen of Dr. Conolly is calculated to confirm both the pathological *and* the therapeutical views contained in the last and in the present chapter. On this account, and not the less for the sake of the eloquence brought to bear on the important subject of which it treats, I would fain borrow it as a demonstration of the foregoing opinions.

"Exactly opposite to the state just described, is that of many individuals in whom the brain seems too readily to sympathise with temporary conditions of the intestinal canal; but shows the sympathy in phenomena of a different character. The general dissatisfaction which so many complain of at some time or other, the state in which nothing in the prospects of the world gives pleasure or affords hope, is often but a mere result of this sort of sympathy; and when the disordered state which calls up that parti-

cular sympathy is corrected, the melancholy is gone. It is mortifying to human pride to allow, that good humour may be wholly put to flight by a temporary fit of indigestion; and that the power of attention may be lessened, the strength of the memory decreased, and all the lustre of the imagination obscured, by a neglected state of the bowels; but the fact is too familiar to be disavowed; and even the restoration and invigoration of those powers which approach nearest to what is divine, are certainly often best effected by such common means as are directed to remove the disordered states of the stomach and of the intestinal canal. There are, therefore, no persons who suffer more grievous mental disturbance than those who are afflicted with chronic disease of the digestive organs; which are, indeed, found to be a very frequent origin of actual insanity. The disordered state of thoughts, the impairment of attention, the oppression of the mind, which was at first slight and occasional, and therefore hardly attended to, becomes more and more frequent, and by this repetition, and by neglect, more severe, until the attention cannot be controlled, and some sensation or emotion obtains undue influence, because the comparing power cannot be exerted upon it; and the judgment becomes on one or more points impaired, or the irritability of the mind becomes general and constant, and interferes with the healthy action of every faculty. Such effects are most readily produced in persons of whom the brain is most susceptible, and they are strongly exhibited in childhood, which is the age of susceptibility. A lively child is allowed to have improper food, and in immoderate quantity. The body is disordered; the breath becomes fetid, the tongue white, the stomach irritable, the bowels inactive, and the skin hot. With these changes, the mind is remarkably affected; the child neglects its accustomed play, is listless and dull, and cannot attend to its lesson; it is

fretful and irritable ; and either cannot sleep, or is disturbed by alarming dreams, or delirium comes on during the night. All these symptoms yield to medicine, which acts freely on the bowels ; and in a single day, the child is restored to bodily activity, the breath is improved, the tongue is clean, the sickness has gone, the fever exists no longer, and the mind is restored to its usual happy state of activity during the day, and natural repose at night. I am disposed to think, that no cause of insanity is more common than habitual, insidious, and neglected irritation of the stomach and intestines. The ultimate effects alone are generally perceived by the patient, and the previous symptoms of indigestion, or of irritation, excite little attention. The common consequences of this disordered state of the intestinal canal seem to be, certain irregularities in the circulation, either limited to certain parts of the nervous system, or most felt in parts predisposed to disease, by some state of infirmity or susceptibility, which the pathologist cannot demonstrate ; but which renders such parts or portions peculiarly intolerant of such disturbance. In one case, from such a combination of causes, hysteria may be produced ; in another, epilepsy ; in another, apoplexy or palsy ; and in another, mania. In the latter event, the mania takes its modification and character from the previous habits and thoughts of the patient ; and some are melancholy, and others gay ; some full of ambitious hope, and others given up to despair. Even the tremors, the causeless fears, the unwillingness to meet strangers, and other peculiarities of nervous persons, may sometimes be traced to this cause, and readily removed."

The following circumstance I consider an interesting one. An old and infirm woman, an inmate of the Hanwell Asylum, was attacked with purulent ophthalmia. I applied the Sol. Argent. Nit. to the affected parts ; and quinine was

given to her. This patient happened, at this very time, to be suffering very much from *asthma*; to which she was liable. The effect of the quinine on the *asthma* was highly satisfactory. The respiration became so easy, under its use, that it was really astonishing. I took the hint, and, on every recurrence of the disease in her, satisfactorily proved its remedial powers. I will not venture to explain the *modus operandi* of quinine in asthma; but presuming that the *pulmonic plexus* is the seat of this peculiar morbid phenomenon (see last chapter), the *LOCALE* of its action is at any rate to be inferred. The 'Medical Times:' has a paper on "Quinine in Asthma," from the pen of B. R. Hogan, Esq., United States. This gentleman asserts that quinine administered in doses of from two to eight grains, repeated in an hour, if relief does not follow, has cured every case of asthma in which he has tried it. He was induced to try it in asthma, in consequence of its known efficacy in all paroxysmal and congestive diseases. Probably quinine would be found serviceable both in angina pectoris and in *hooping-cough*; also in some cases of "crowing respiration," and particularly so if preceded by mild purgation.¹

In accordance with the pathological views expressed in the last chapter, concerning *dysentery*, I have ever been in the habit of treating this disease, principally, with *opium*.¹ Two or even three grains of opium, with two grains of Hydr. c. Creta, and a grain or a grain and a half of Ipecacuanha, are given every two or three hours, to three or four doses with great advantage. (The effects of the opium must be, of course, looked after.) The dysenteric symptoms, *if recent*, are generally subdued by this treatment; when, after waiting a few hours, some mild aperient, as castor oil,

¹ Since the above was written, I have prescribed quinine with Dover's powder in *hooping-cough*, with some advantage.

may be given to remove any morbid matter or irritating secretions from the intestinal canal, as well as to aid in the restoration of the normal functions of the parts concerned. In chronic cases the Argent. Nit. c. P. Opii will be found of the greatest service.

I would add that the foregoing remarks as to the treatment of abnormal action, involving the ganglionic system—by whatever individual names recognised—are to be viewed rather in a *general* than in a *particular* sense; they form, it is thought, a very natural accompaniment or corollary, to or of those parts of this volume which treat of the *structure, functions, and diseases* of the NERVE-TISSUE just named. The reader then will fill up the therapeutical *hiatus* with materials of his own seeking—the profits of his own mental investments.

FINIS.

...to the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

...the ... of the ...
...the ... of the ...
...the ... of the ...
...the ... of the ...

MANUAL

OF THE

OFFICE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE

OF THE



Davey, James George

The Ganglionic Nervous System; its Structure, Functions, and Diseases

London 1858

Path. 294 e

urn:nbn:de:bvb:12-bsb10471433-0